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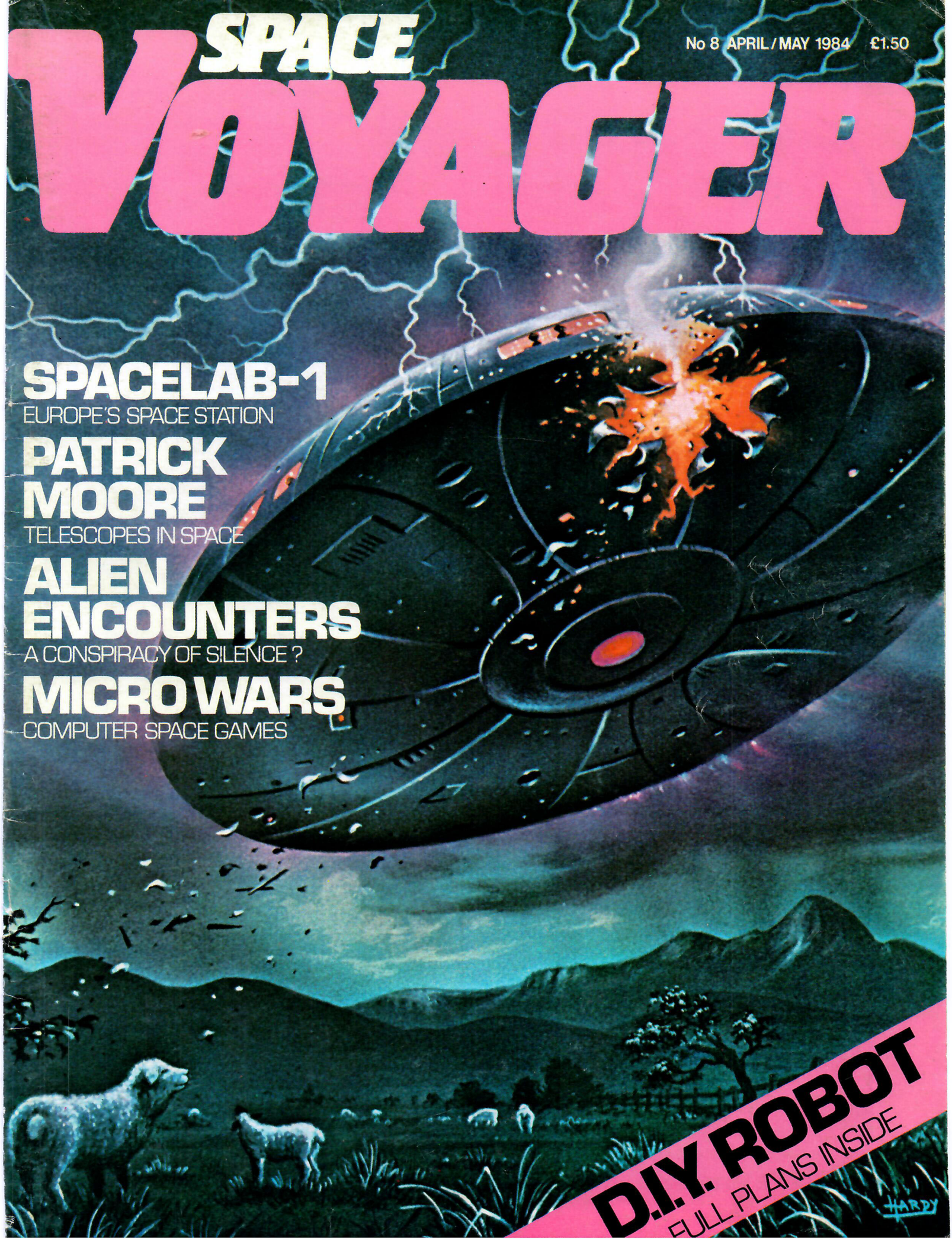
SPACE VOYAGER



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SPACE VOYAGER

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Front cover illustration: by David Hardy. For more of David Hardy's work, see page 26. Back cover: Tank turmoil Tron-style. Photo: © Walt Disney.

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CAPTAIN'S LOG

Taking control of the editorial reins once wielded by Ray Rimell and Mat Irvine is no mean feat. Soon after my arrival on the bridge, a cavernous helm echoing to the sound of a lone art editor beavering away, I learned how enthusiastically readers and contributors alike have supported the magazine. I have not been short of willing advisors – the SF fans must have more SF and not that media rubbish either; the spaceflight fans must have more space features; the modellers . . . etc.

VOYAGER evolution

Ask a dozen editors what they would put in a magazine and you'll get a dozen different magazines, so you can expect Space VOYAGER to change a little in future. I hope its development will reflect your requirements and interests as readers, and I can only gauge those by responding to your views. So, I'm looking forward to a healthy postbag. Don't just write to complain – if you particularly enjoy an article, try to find a few moments to put pen to paper. It's the only way you silent majority out there can have the magazine you want. Very soon I hope to be able to publish another reader survey, so that I can get to know you and what you think of VOYAGER even better. Until then, keep the *Communications Bank* well stocked.

April/May VOYAGER

In this issue, Patrick Moore takes a trip into Earth orbit to survey the telescopes to be found there and what they're looking at. Mark Gorton of Granada Television launches his regular column on SF home video and he doesn't pull any punches. Peter Freebrey lights the blue touch paper on his model rocketry series. Shuttle Update is devoted to an in-depth report on the greatest thing to happen to Europe since Lymeswold cheese – Spacelab of course. Peter Holland gives full details of how you can build your own robot. You can win a copy of Patrick Moore's superb History of Astronomy, published by Macdonald, in the VOYAGER Astronomy Guiz. If you find that too easy, Simon Goodall has set a pretty stiff test of your Star Wars knowledge.

San Jose science journalist, Karen Klinger, goes behind the scenes at California's famous Ames Research Centre to report on the story of Pioneer Saturn. Futures correspondent, Andrew Nimmo, polishes his crystal ball and looks into the future of orbiting factories and research laboratories, the industrialisation of near-Earth space.

Micro Wars

Talking of wars (pretend ones, that is) – in Micro Wars, we will review home computer space games. I hoped to kick off the series with software for the Sinclair Spectrum and BBC Model B, but an unco-operative system means that Spectrum owners will have to wait until the next issue for their particular micro diversions. So, this issue's Micro Wars is devoted exclusively to the BBC Micro. Incidentally, many of the excellent stories that you're about to read in Voyager were written or edited with the aid of a BBC Micro used as a word processor. (For computer buffs, the system comprises a BBC Micro Model B fitted with a Wordwise ROM, a Microvitec 14-inch Cub RGB monitor, a single 100K floppy disk drive and a Centronics 739 printer).

Current affairs

A re-organised *Databank* brings you a jumbo-sized instalment of news. Beginning as usual with the *Databank* general news, it then goes on to bring you up to date with the latest happenings at NASA in America, ESA in Europe and, for the first time, regular space news from the Soviet Union (provided by the Novosti Press Agency's London and Moscow bureaux).

So, there you have it – spaceflight, rocket modelling, robots, feature films, home video, computer space games, SF books, UFOs, competitions and news, news, news!!! And, there's another one coming along in two months.

Caption Competition

Down in the basement of Wolsey House, you see one of the candidates for the position of advertisement manager undergoing/suffering her interview. The interviews are held in the teleportation room next to the cloning and transplant theatre. But what on Earth are all those tubes for? Why is she wearing headphones? Is it some devillish form of lie detector? What's in the box at the left, to which one of the tubes is connected?

If you can shed some light on the particular interviewing technique going on here, you could win a modest mystery prize ('mystery', because we haven't decided what it is yet!). Send your witty photo caption explaining what's happening or what one of the participants is saying to the other to:

Caption Competition
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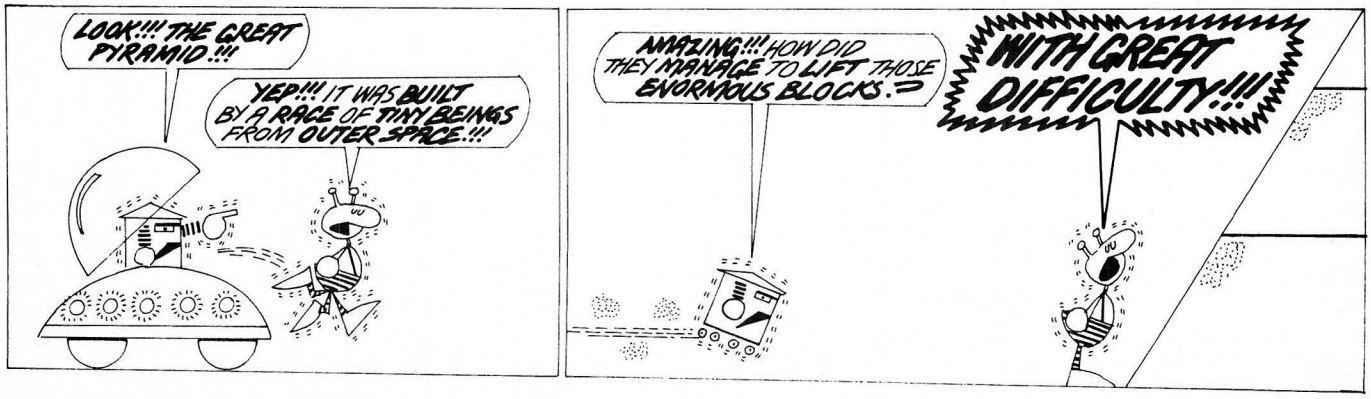
Entries by April 9th please, giving you a month from this issue's publication date to switch your brain into creative mode. Look out for further equally silly competitions in future issues.

PLUTONIUM PETE BY ROBINSON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YEP!!! IT WAS BUILT BY A RACE OF TINY BEINGS FROM OUTER SPACE!!!
AMAZING!!! HOW DID THEY MANAGE TO LIFT THOSE ENORMOUS BLOCKS.⇒
WITH GREAT DIFFICULTY!!!

DATA BANK

Jetstream success

British Aerospace has secured a £20 million order for its Jetstream 31 light turboprop transport aircraft. The purchasher, Metro Airlines Inc of Houston, Texas, will use the aircraft in conjunction with Eastern Airlines to operate commuter and connecting services into Atlanta, Georgia.

This order brings Jetstream 31's total sales to date to 36 and makes Metro the largest fleet operator of Jetstream 31s in the world.

The launch of the Jetstream 31, a 19-seat twin engine aircraft, was announced in December 1978 and the aircraft is now produced at British Aerospace's Scottish Division at Prestwick.

Jetstream 31. Photo: British Aerospace.

Southern Skies

One of the disadvantages of living in the northern hemisphere is that you can't see astronomical objects in the southern skies. The 3.9 metres Anglo-Australian Telescope at Siding Spring Observatory in New South Wales can see objects normally invisible to us. Now we, too, can see them by way of Space Frontiers, the Hampshire-based company. Space Frontiers have issued a set of 12 colour slides showing a range of objects photographed by the telescope, including the Cone Nebula, M16 (a cluster of young stars), the Helix Nebula (our nearest planetary nebula) and the Wolf-Rayet Star (an odd structure formed by a star 'throwing off' its outer layers).

You can obtain this colourful 12-slide set, called 'In Southern Skies' by sending £4.50 (including postage and VAT) to Space Frontiers Ltd, 30 Fifth Avenue, Havant, Hampshire PO9 2PL.

A Databank item in Space Voyager No 7, February/March 1984, gave the impression that a 'Bring Back Blakes 7' demonstration at the BBC was organised as part of the Galacticon convention. The convention organisers have asked us to make it clear that the demo and the convention were unconnected.

Looking ahead

Personal wrist communicators will be with us in about 12 years, predicted Mark Martin, assistant chief engineer of British Aerospace Dynamics. He was talking to the Royal Aeronautical Society at British Aerospace Warton recently.

Mr Martin, a Fellow of the British Interplanetary Society, was talking on 'future space transportation systems' and covered everything from communications satellites to space stations.

He told RAS members that the biggest communications satellite in the world is being built at the British Aerospace plant in Stevenage. He also predicted that the first space factory would come within a decade and plans for a permanent space station would be announced soon, as part of President Reagan's election campaign.

Who's got the first Whos?

Has anyone out there got any copies of the old black and white episodes of Doctor Who?

Back in 1972 the BBC still had all the episodes in their archives, but between 1972 and 1976 someone decided to destroy them. No less than 131 episodes have gone forever. Initially, 137 disappeared, but an appeal brought copies of six programmes to light.

All the missing episodes come from the William Hartnell and Patrick Troughton years, and the Dr Who office is still very keen to track down any copies that might be about. As domestic video recorders weren't around when these episodes were first screened (doesn't it make you feel old?), there doesn't seem to be much hope of obtaining copies. However, some countries are a few years behind us in Who screenings, so there may be some copies of the lost programmes abroad. Why not ask your Who-fan friends in other countries if they can help? If you turn anything up, contact the Dr Who office, BBC TV Centre, Wood Lane, London W12 8QT (and mention Space Voyager).

New Who

Regular Voyager readers will undoubtedly remember Wendy Graham's interview with the new Dr Who, Colin Baker, in issue no 6. The report was published shortly after the nation

CONVENTION CALENDAR

By Marion van der Voort

Apr 7 COMIC MART, Central Hall, Westminster, London. (opp Parliament). Afternoon only. Free admission.

Apr 20-24 SEACON, SF. Brighton (Not only the usual Eastercon, but also the first ever Eurocon in this country). Guests Roger Zelazny, Chris Priest, Pierre Barbet. Write Pauline Morgan, 321 Sarehole Road, Hall Green, BIRMINGHAM B28 0AL.

May 4-7 UFP CON 84. Star Trek. Manchester. Write Kim Knight, 135, Greensted Road, LOUGHTON Essex IG10 3DJ.

May 25-28 TYNECON II, SF. NEWCASTLE UPON TYNE. Write Sue Williams, 19, Jesmond Dene Road, Jesmond NOT NE2 3QT.

June 2 COMIC MART as Apr 7.

July 20-23 ALBACON 84. SF. Glasgow. Guests Harlan Ellison. Write Ms F J Nelson, 62 Campsie Road, Wishaw ML2 7QC.

July 20-23 FAIRCON 84, SF. Glasgow. Guests Sydney Jordan & Mat Irvine. Write C/O Bob Shaw 2/1 244 West Pinces Street, Kelvinbridge, Glasgow G4 9DP.

Aug 4-5 THE LEISURE HIVE, Dr Who. Swindon. Write Tony Cherrington, 2 Domestic Quarters, Bryanston School, BLANDFORD, Dorset.

Aug 17-19 FANDERSON 84, Gerry Anderson. London. Write PO Box 308, London W4 1QL.

Aug 24-27 GALILEO CON 84, Star Trek. NEWCASTLE UPON TYNE. Write Catherine Richardson, 30, Kirkdale Green, Rye Hill Estate, NOT NE4 6HU.

Aug 31-Sep 2 BENELUXCON, SF. Ghent, Belgium. Guests Robert Sheckley, James White, Michael Kubiak. Write Andre De Ryke, Eendenplasstraat 70, B-9050 Evergen, Belgium.

Sep 7-9 MYTHCON. Fantasy. Hull. Guests Anne McCaffrey, Brian Froud, Jack Cohen. Write Marion van der Voort, 133, Sheen Lane, London SW14 8AE.

Oct 12-14 CONQUEST. (Mainly Elfquest) Glasgow. Guests Richard and Wendy Pini. Write Pat Brown, 104, Pretoria Road, Patchway, BRISTOL BS12 5PZ.

Oct 27-28 GALACTICON 84. Mainly Blakes 7 & Battlestar Galactica. London. Write Irene Ambrose, 171 Heath Road, HOUNSLOW, Mddx.

Please enclose a S.A.E. or I.R.C. when writing.

DATA BANK

learned that Baker was to be the new incumbent of the coveted role.

Interviewer Wendy Graham had discussed how the Doctor should be played. The verdict was 'more eccentric and with more of a sense of humour.' No surprise there, you may think, but the interview and discussion about Dr Who all happened weeks before the BBC and Baker got together to talk about their future together.

Script editor John Saward revealed that 'the Doctor will be developing a dry sense of humour, the sort that comes from one-liners or even glances.'

Top space award

Peter Hickman, head of space and communications for British Aerospace, has been awarded one of Europe's top space engineering awards.

The Gairn EEC medal of the Society of Engineers has been presented to him for his work on the European Communications Satellite (ECS), the first of which is now in orbit.

The medal is awarded in alternate years to an engineer of one of the EEC countries for an important contribution to contemporary engineering, science or technology. It is the first time the award has come to Britain.

Mr Hickman began his career with English Electric Aviation in 1952 after graduating from Nottingham University. He moved to de Havilland Propellors who became part of

Peter Hickman

Hawker Siddeley Dynamics. In 1980, after British Aerospace was created, he was appointed managing director of the Space and Communications Division.

He is a member of the United Kingdom Industrial Space Committee, Chairman of the Satellite Broadcasting Committee and a director of Satcom International, the joint British Aerospace/Matra company.

Satellite television

Ten thousand cable television subscribers in the Swindon area will by now have had their first taste of satellite television. They are the first residents of this sceptr'd isle, this royal seat of kings, this precious stone set in a silver sea, etc, etc (apologies to W Shakespeare) to receive their television programmes from a tin box in space.

The new network, Sky Channel, will be screening sports, light entertainment and documentary programmes, but not news or current affairs. The programmes are beamed up to the European Communications Satellite (ECS) and relayed down to anyone who cares to rent the airwaves. In this case, the programmes are received by Swindon's local cable TV station and fed down the cable to its subscribers with all the other channels.

The advantage of that is that the subscribers need no extra boxes of electronics or aerials. The programmes are received centrally at the cable station. The disadvantage is that the subscribers are stuck with the satellite service chosen by their cable operator. That doesn't matter now, because Sky channel is in a one-horse race, but in not so many years there will be a few more satellite channels around. Then, individual households may prefer to bolt a

NASA NEWS

Space sickness

It has long been thought by medical researchers that there is a system linking the body's balancing mechanism in the inner ear (the vestibular system) and the vomiting centres in the brain, but the link has eluded investigators.

The connection is known to us all in practice – when you become disorientated, you may feel sick. Some people are affected, or perhaps afflicted is more appropriate, much more than others – we call it car sickness, sea sickness or simply motion sickness.

Now reseachers at NASA's Ames Research Centre and Johnson Space Centre think they have found the link, not through the neural (nerve) connections of the body's central nervous system, as expected, but in the cerebrospinal fluid, a watery fluid surrounding the brain and spinal chord. The possibility of a chemical link was discovered during research into space sickness.

Dr Nancy Daunton at Ames and Drs Crampton and Lucot at Wright State University, Ohio, found that nausea and sickness could be eliminated by blocking the flow of cerebrospinal fluid in and around the brain. Incomplete blocking did not prevent sickness.

The next step is to isolate the chemical substance involved and find out how it works. Then perhaps its effects could be eliminated. Astronauts would surely be thankful for that, because no less than 50% of these 'supermen' suffer from motion sickness in space.

Hubble-oscopy

The optical telescope due to be launched by the Space Shuttle in 1986 has until now been known by the straightforward name of 'The Space Telescope'. It will now be known by the grander title of the Hubble Space Telescope, honouring the astronomer whose research fundamentally changed our view of the structure of the known universe.

Edward Hubble, using a 2.5 metres telescope at Mount Wilson in California in the 1920s ended the debate between astronomers about the extent of our system and what exactly it contained. He proved once and for all that spiral nueullae were not, as some believed, structures without our galaxy (the Milky Way), but were in fact themselves galaxies very much more distant than any star in our own galaxy.

Hubble also determined that our universe is expanding. He continued working from the 1920s right up to his death in 1953.

Shuttle headlights

The Space Shuttle doesn't 'shut up shop' just because the Sun goes down. In fact, some experiments must be carried out against a dark sky background. It's easy to imagine, therefore, that manoeuvring the Orbiter near satellites during periods of darkness might be dangerous. The satellite simply disappears into the blackness of space. The Orbiter, from STS-11 onwards, will carry powerful quartz iodide and xenon lights to illuminate objects near the craft in space to permit safe movements.

Weightless blood

The Earth's gravity gives the human body something to work against and as everyone knows, muscles that work against resistance grow and maintain good tone. In orbit, though, there's nothing for the body to work against – movement in any direction is effortless. In these weightless conditions the body begins to undergo a process of adaptation. Muscles waste, the balance centres in the brain may be upset and more complex chemical changes occur thoughout the body.

When an astronaut first reaches orbit, insulin and glucose levels in the blood increase, but settle down to normal again after exercise. Researchers at the Ames Centre in California confined some human guinea pigs to bed for a week or two (in the same position!) to simulate weightlessness. Drs Dolkas and Monon found that the body's cells gradually lost the ability to use glucose, and so it stayed in their bloodstream. Insulin, too, is produced in normal quantities, but isn't used, hence the higher insulin levels in the blood.

satellite receiving dish onto their roofs and point it at their choice of satellite.

By the end of 1984, Sky Channel hopes to be on screens in 400,000 homes, rising to a million by the end of 1985.

Who's home

Dr Who fans may have seen a recent report that the BBC has decided to junk the Doctor's trademark – no, not the sonic screwdriver (whatever happened to that anyway?), but the TARDIS. At a time when there are precious few police phone boxes around, the powers that be were said to have come to the conclusion that the battered box is no longer appropriate. The new-Who, Colin Baker, was reported to be adamant that the box should stay. The alleged difference of opinion certainly secured a few column inches in the national press, but was it any more than a publicity stunt? Has the TARDIS made its last trunk call? If so, what will it be replaced by? Is there any truth in the rumour that the superloo in Leicester Square has attended an audition? Watch this space.

COMPETITION WINNERS

Guiz 2 in VOYAGER No 6 attracted a respectable crop of replies. They all went into the capacious competition hat and the winners were duly drawn. We had hoped to present all five winners with Revell's giant 1/96th scale Saturn 5 model construction kit, the largest rocket kit ever produced. However, there are only three of these kits left in the country! Revell have kindly donated these to our Guiz winners. So, back into the hat went the five to pick the lucky three who will indeed receive these collector's items. The three proud rocket owners are – Charles Evans from Largs, Ayrshire; Mr A T Smith from Yeovil, Somerset and Keith Scaife from Leek in Staffs.

Now, what about the other two winners? Revell have agreed to award them with alternative space kits, and they are – David Sixsmith from Burnley, Lancs and Michael O'Key from Allestree, Derby.

Five runners up each receive the best prize of all – a year's subscription to Space VOYAGER, the most sought after of all the prizes. The lucky five are – Mr M Steel from Collingham, Wetherby; Steve Pochly from Maidenhead, Berks; Randal Scott from Coleraine, Northern Ireland; Mr H Dayus from London W11 and Mr J D Griffiths from Plympton, Plymouth.

Best-selling Author Anne McCaffrey reveals an excellent taste in reading matter (Space Voyager) at Galacticon.

In the long term, perhaps during a very long spaceflight, high blood sugar levels could lead to serious heart and circulation problems. Fortunately, the research shows that the high glucose and insulin levels in the blood can be reduced by taking exercise and following a low-calorie diet. The precise mechanism involved isn't understood yet. It is hoped that the research will yield benefits for Earth-bound diabetics (who produce too little insulin) and hypoglycemics (who have abnormally low blood sugar levels).

New JPL deputy

Lt General Charles H Terhune Jr has retired as deputy director of California's Jet Propulsion Laboratory. He has been replaced by associate director Robert J Parks.

Terhune joined JPL in 1971 after leaving the US Air Force and was responsible for the day-to-day management of the Laboratory's resources and the direction and co-ordination of its technical, administrative and service activities.

His successor, Robert Parks, joined JPL in 1947 and has been closely associated with the planetary exploration programme. He was responsible for an impressive list of projects – Mariner 2, Venus fly-past in 1962, Rangers 7, 8 and 9, which produced the first close-up photos of the moon, Mariner 4, the first spacecraft to photograph Mars in 1965, the Surveyor Lunar-lander series, Mariner 5 to Venus in 1967, Mariners 6 and 7 to Mars in 1969, Mariner 9 to Mars in 1971, Mariner 10 to Venus and Mercury and the Voyager project to Jupiter and Saturn (phew!).

1983 highlights

It's been a good year for NASA. There were four successful launches of the Space Shuttle, including the first three flights of the second Orbiter, Challenger. In the last mission of the year, Columbia carried the 1000 million dollar re-usable Spacelab-1 and more than three tons of experiments into orbit.

In April, astronauts Peterson and Musgrave carried out the first EVA (spacewalk) for nine years. On Challenger's maiden flight, the two spacewalkers practiced working outside the Orbiter, attached to it by 15-metre tethers. NASA administrator, James Beggs, revealed that on mission 13 (now planned for April this year), astronauts will actually attempt to repair a satellite in orbit. An astronaut wearing a backpack equipped with small thrusters will leave the Orbiter and manoeuvre himself freely in space.

Challenger's first flight also launched the first Tracking and Data Relay Satellite (TRDS), the first of three which will provide orbiting satellites with continuous voice, data and data communications. Spacelab used this TRDS to transfer data to Earth at a staggering 300 million bits of information per second.

Challenger's second mission carried America's first astro-lady, Sally Ride. It's third mission carried the first black American astronaut – no, not Jesse Jackson campaigning for the Presidency – it was a gentleman by the name of Guion Bluford.

The third Orbiter, Discovery, arrived at Cape Canaveral in November. Officials say it will fly at least four missions this year (beginning in June).

In addition to the Shuttle flights, there were 12 successful NASA launches of expendable rockets, carrying mainly commercial and international communications satellites.

In June 1983, a small spacecraft launched 12 years ago left the Solar System. By the time Pioneer 10 shot beyond the orbits of the outer planets at almost 50 000 kilometres per hour, it had travelled 3590 million miles and received 99 000 commands from Earth.

Pioneer 10 discovered that Jupiter is a liquid planet with powerful radiation belts. It took the first close-up pictures of the Great Red Spot. It is still working, gathering information about the Solar Wind beyond the outer planets.

In December, the International Sun-Earth Explorer (ISEE-3) used the moon's gravity to swing it into a course which will take it to the first rendezvous between a spacecraft and a comet. The comet in question is Giacobini-Zinner and the meeting should take place in September 1985.

Of course, IRAS, the Infra-Red Astronomical Satellite launched in January 1983, has been so successful that it's almost impossible to keep up with its observations and discoveries. These include the detection of cold astronomical objects believed to be distant spiral galaxies, five new comets and new dust clouds harbouring newly formed stars.

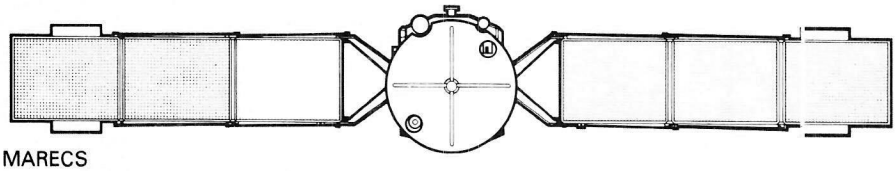
The future? NASA officials say that work on a permanent orbiting space station is inevitable. It could lead to a manned mission to Mars. This could be accomplished for a mere 20 000 million dollars – a huge sum, but only a third of the cost of the Apollo programme.

ESA NEWS

Europe-Canada pact

In January this year, Canadian and ESA officials met at the European Space Agency's Research and Technology Centre (ESTEC) in Noordwijk, The Netherlands, to sign a new five year co-operation agreement. This extends the first such agreement made in January 1979.

Canada is to contribute more to the Agency's general budget and will continue to participate in a number of optional programmes – in particular, in the Earth observation and satellite broadcasting fields. ESA and Canada will, where possible, make use of each other's space facilities, services and products, including launch facilities. After the third year of the agreement, even closer co-operation is to be discussed, with the possibility of Canada becoming an associate member of ESA.



MARECS

MARECS success

A largely British satellite in orbit 22 000 miles above the Atlantic is performing better than even its makers, a European consortium led by British Aerospace, predicted that it would.

Marecs-A's 46 channels are now carrying the whole of the satellite communications traffic between ships and shore bases in the Atlantic region.

The satellite, launched just over two years ago, has been operational since May 1982 and until recently was carrying 30 simultaneous voice channels. Then last November the European Space Operations Centre (ESOC) in West Germany was asked by the International Maritime Satellite Organisation (INMARSAT) to increase the capacity to 46 channels. This exceeds the contractual requirement for Marecs-A, which was set at 40 channels.

ESOC was able to carry out the switching

SOVIET NEWS

Soviet-Indian mission

Crews selected for the forthcoming joint Soviet-Indian manned spaceflight have now completed basic training. Two crews are currently undergoing training at the Yuri Gagarin Cosmonaut's training centre near Moscow.

The first crew comprises Yuri Malyshev (commander), Nikolai Rukavishnikov and Indian cosmonaut-researcher Rakesh Sharma. The members of the second are Anatoly Berezovoi, Georgy Grechko and Ravish Malhotra.

In an interview with a Tass correspondent, commander Yuri Malyshev explained that the crew had now been trained in the basic skills necessary for the flight – achieving orbit, controlling the craft in orbit and bringing the descent module down to a soft landing on Earth. Malyshev also explained that the next stage of training would concentrate on dealing with possible but unlikely situations, which demanded a thorough knowledge of equipment.

The Indian cosmonauts are now spending their second winter in the Moscow region. Relations between them and their Soviet hosts is reported to be warm and friendly, in contrast to the icy weather.

The Biosputnik program

When is a Sputnik not a Sputnik? When it's a Biosputnik!

The Soviet manned space programme naturally steals the limelight from many other areas of activity. A programme of biological research using small animals, plants and micro-organisms has been going on in parallel with and overshadowed by the manned missions since 1973. These biological research craft are known colloquially as 'Biosputniks'.

One of them, Cosmos 1514, was launched on December 14th and returned to Earth six days later with its payload of rats, fish and monkeys. The main aim of the experiments to which the animals were subjected was to study how live organisms adapt to conditions in space – primarily weightlessness. One of the experimental directors, Dr Yevgeni Ilyin, said that the precise mechanism by which an organism adapts to weightlessness during the first hours of a flight is not fully understood yet. It's a difficult area for investigation during manned missions, because the crew are not free for experimentation during the critical launch to orbit period. Two monkeys, called Abrek and Bion, on-board Cosmos 1514 were therefore used in place of a human crew for experimental purposes. All the animals are reported to have survived their weightless experience.

Scientists from Bulgaria, Hungary, East Germany, Poland, Rumania, Czechoslovakia, France and the United States contributed to the project. Five Biosputniks have been launched since 1973.

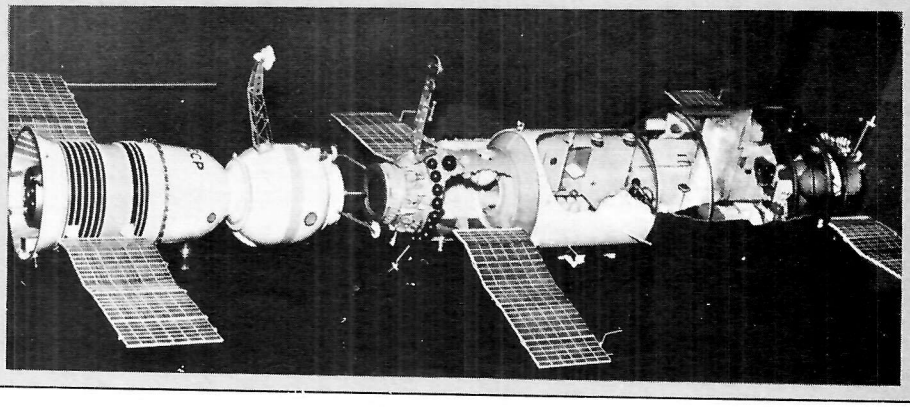
Salyut 7

At a press conference to mark the successful completion of a 150-day Salyut 7/Soyuz T9 mission, Vladimir Lyakhov, commander of the orbiting station, reviewed the flight and looked forward to the next year in space.

Lyakhov and his flight engineer, Alexander Alexandrov, carried out around 300 experiments, mainly in geophysics and astrophysics. In particular, they conducted an 'exploration' of the Black Sea area. Approximately 100 of the experiments were devoted to medicine and biology. Hardware that will be built into future spacecraft was also tested.

The crew spent nearly six hours outside their space station assembling additional solar panels. During the flight, a Cosmos 1443 heavy freight satellite carrying three tons of supplies and Progress 17 and 18 automatic cargo craft docked with Salyut. The Cosmos 1443 took over control of the orientation of the combined structure for a time and returned some materials and experimental results to Earth. The crew landed in the descent module

This model shows an earlier Soviet manned spacecraft (Soyuz 11) docked with a Salyut orbiting space station.



process in less than ten minutes. A European Space Agency spokesman was later quoted as saying that this boded well for Marecs-A continuing to play its part over its design lifetime of seven years.

The satellite's twin, Marecs-B, was lost because of a fault in its Ariane launch rocket. However, Marecs-B mark two is under construction at British Aerospace (Stevenage), with a launch expected in April.

Son of IRAS?

Looking ahead to Spacelab-2, scheduled for launch by Space Shuttle in 1985, the infra-red telescope it is to carry has now been completed and is undergoing testing at the Marshall Space Flight Centre.

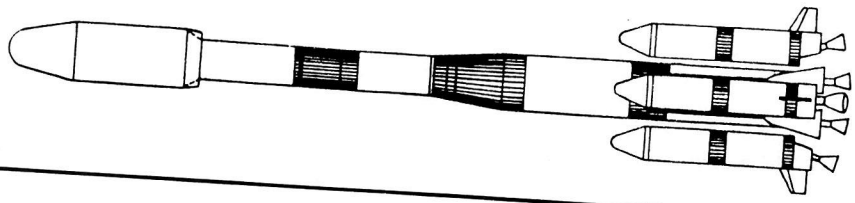
The telescope is a small instrument – only one of 13 instruments on the mission. The instrument is housed in a cryostat (a vessel maintained at low temperatures) served by a 250 litre helium container. Thus, the telescope will operate at the distinctly chilly temperature of –272 degrees centigrade.

The instrument works by focusing radiation from deep space onto a super-cooled mirror, from where it is reflected onto an array of nine infra-red detectors. The telescope is kept so cold, because as it is measuring the heat given off by distant objects, experimenters must be sure that the telescope isn't registering heat generated by itself, rendering its results meaningless. At –272 degrees, almost all molecular activity has ceased – it's only one degree higher than the coldest possible temperature – absolute zero!

Ariane 4

ESA recognises that from 1985 launchers will have to place larger and larger payloads in orbit. Eventually the current Ariane rocket simply won't be powerful enough. Consequently, they are planning future Arianes with sufficient power for future requirements. The six versions of the planned Ariane type 4 will be able to place between two and over four tonnes (1 tonne = 1000 kg) in orbit.

Already, France's space and communications agencies have revealed plans to take advantage of the extra power that Ariane type 4 offers, to launch an 880 kg satellite called 'Athos'. The payload will investigate the use of very high frequencies for communications. Those in use now are becoming overcrowded. The frequencies under consideration are in the range 20 to 90 gigahertz (1 gigahertz = one million million cycles per second).



of their Soyuz T9 craft as planned, 160 kms east of the town of Dzhezkasgan. On their return, both cosmonauts were awarded the Order of Lenin and the Gold Star medal (Lyakhov's second).

The constructional work carried out outside the station, the docking with unmanned cargo ships and the experiments in guiding the docked craft were all clearly rehearsals for the construction and management of much larger orbiting structures – space stations.

Looking ahead, Director of Soviet Cosmonaut Training, Vladimir Shatalov, revealed that Salyut 7 will be visited this year by the joint Soviet-Indian mission crews, Shatalov and Academician Roald Sagdeyev, Director of the Moscow Institute of Space Exploration, stressed the peaceful aims of the mission. Shatalov went further, condemning the 'militaristic' exploitation of space by the United States. He cited the co-operation between the Soviet Union and America, which led to the joint Apollo-Soyuz mission in 1975, and looked forward to such close co-operation again in the future.

The only example to date of Soviet-American co-operation in manned spaceflight – the Apollo-Soyuz Test Project (ASTP) in 1975. From left to right, the crew members were – Vance Brand, Alexei Leonov, Thomas Stafford, 'Deke' Slayton and Valery Kubasov.

Astron yields results

Andrei Severny, Director of the Crimean Astrophysical Observatory, recently reviewed the progress of the Soviet astronomical satellite Astron, which was launched last year. The satellite's instruments have been looking at far-off celestial objects. It has established that giant stars eject matter with enormous energy, producting ejection velocities of up to 800 kms per second.

Severny described how Astron discovered more lead and tungsten in the atmospheres of 'magnetic' stars than in our Sun's atmosphere. If all the elements now in existence were formed in the Big Bang, then there should be equal numbers of all the different combinations of atoms. In fact, light elements like hydrogen and helium are around one million times more abundant. It was then theorised that the heavier elements were made inside stars by thermonuclear fusion.

Inside stars there is sufficient heat and pressure to force atoms to combine to form heavier and heavier elements . . . up to a point. If the very heavy elements like lead and tungsten are to be produced in the same way, they require some extraordinary conditions – such as those which may be found inside a star collapsing into a white dwarf or a neutron star and also in a supernova flare.

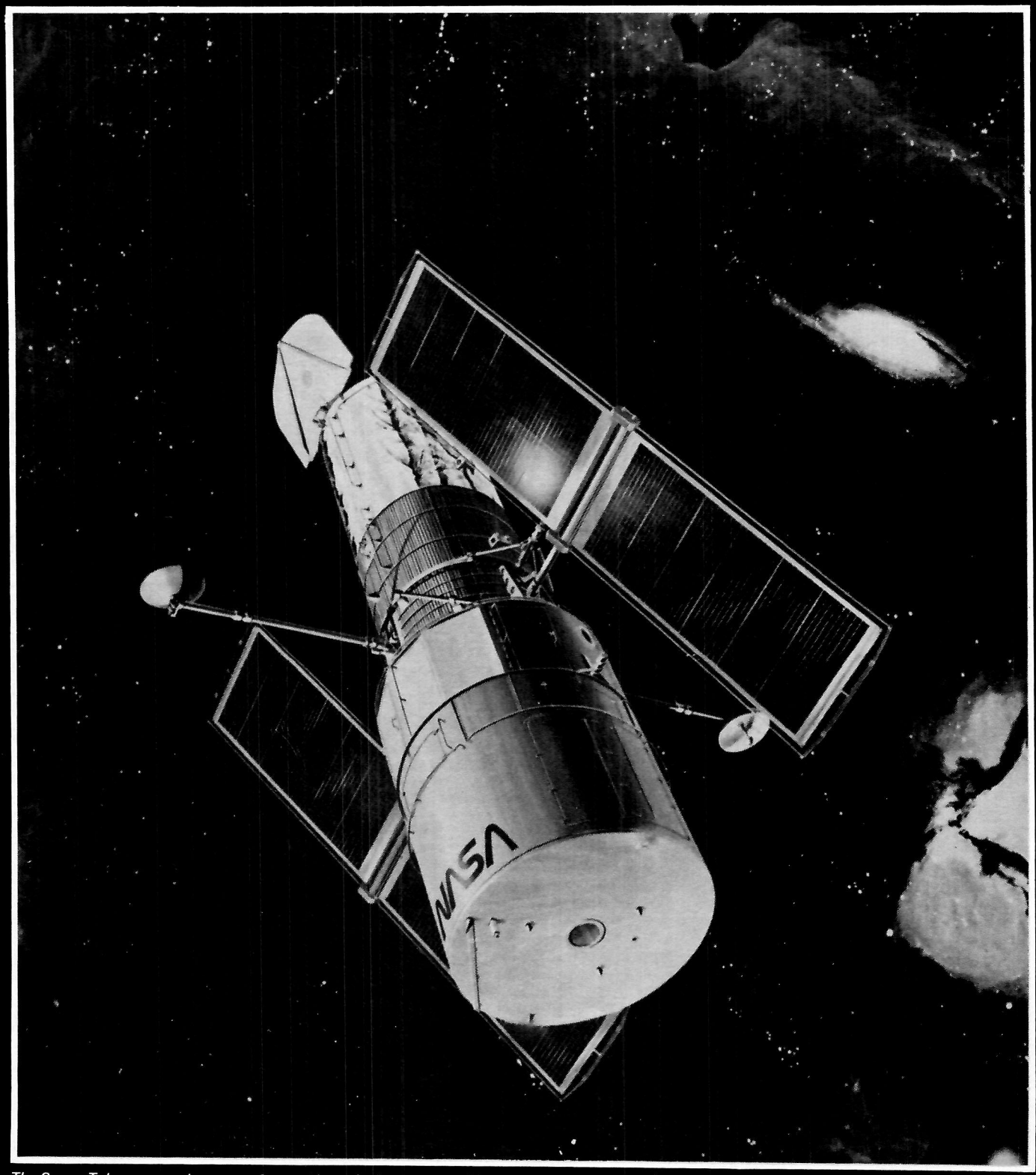
Of course, Severny explained, the heaviest elements might be made by the radiocative disintegration of thorium and uranium, but the amount of time necessary for this is approximately the same as the age of the universe (15 to 20 billion years). However, current theories of star formation begin with gas clouds, within which local irregularities cause regions of stronger gravitational fields. These microgravities attract more material and gradually these knots of matter get bigger and begin to rise in temperature. Only after the stars have formed can they begin to manufacture lead and tungsten by radioactive disintegration. The time scale is all wrong.

Astron's data therefore suggests, according to Severny, that the universe's heavy elements were produced during the formation of supernovas and similar phenomena. Severny is awaiting further returns from Astron with interest.

15 years ago. . .

On January 16th 1969, Soyuz 4 and Soyuz 5 successfully docked in orbit and, for the first time, two cosmonauts changed craft. This embryonic space station rehearsed procedures to be used when the first of seven Salyut space stations was placed in orbit in April 1971.

TELESCOPES



The Space Telescope – a huge step forward in optical astronomy. Photo: Lockheed via British Aerospace.

IN SPACE

THE EARTH'S ATMOSPHERE BLOCKS MOST OF THE RADIATION ARRIVING HERE FROM THE REST OF THE UNIVERSE. PATRICK MOORE EXPLAINS WHY SPACE AGE ASTRONOMERS ARE NOW MOVING THEIR TELESCOPES ABOVE THE ATMOSPHERE.

When I was very young, and just starting to take an interest in astronomy, I managed to borrow a small telescope from a local doctor, and had my first view of the Moon's mountains and craters. It was not a very good view. What I had done, in all innocence, was to perch the telescope upon a table in my bedroom and poke the end of the tube through the window. I could see the Moon, of course; but the image was shimmering and shaking around. Only when I had the sense to take the telescope outdoors did I see the lunar scene clearly.

No doubt the answer should have been obvious enough. My bedroom was much warmer than the air outside, and so the hotter air swirled out, effectively ruining the 'seeing'. It is rather like trying to look straight through a tank of water. But although nobody over the age of seven should make such an error, it does pose some further questions – and problems which astronomers are only now beginning to solve.

The plain truth is that to astronomers, the Earth's atmosphere, which is so essential for us to breathe, is a complete nuisance. First, it is unsteady. Secondly, it blocks out many of the interesting radiations coming from space, so that the information we can receive is at best incomplete. And thirdly, it places a fairly definite limit upon the sizes of telescopes which can be used from ground level.

The unsteadiness shows up on any night when there are no clouds to hide the stars. Stars, as everyone knows, twinkle. This has nothing directly to do with the stars themselves; it is caused entirely by the Earth's air, which, so to speak, shakes the starlight around. Note that a star which is low down twinkles much more than a star which is high up – because the light from the low-altitude star is coming to us via a thicker layer of atmosphere. (Sirius, the brightest star in the sky, is the supreme twinkler; actually it is pure white, but when seen low over the horizon it can flash with various colours of the rainbow.) However, even a star near the zenith or overhead point will twinkle to some extent. It is often said that planets, unlike stars, do not twinkle. This is not strictly true, though I agree that a planet, which appears as a small disk, does twinkle or scintillate less than a star, which appears to all intents and purposes as a point source.

Next, we have to consider various layers in the upper air which – though, again, essential for our existence – handicap the astronomer. What we normally call 'white' light is not white at all, but is made up of all the colours of the rainbow: red, orange, yellow, green, blue, violet. Light may be regarded as a wave-motion, and the colour of the light depends upon the wavelength – the distance between one wave-crest and the next. Red light has the longest wavelength, violet the shortest.

But visible light, from red to violet, is only a very small part of the total range of wavelengths, known technically as 'the electromagnetic spectrum'. Wavelengths longer than that of red light cannot be seen, but they can be felt – as infra-red. Turn on an electric fire, and you will feel the heat (infra-red) well before the bars start to glow. With wavelengths longer still, we come into what is termed the radio range. Radio waves are, basically, just the same as light waves, but their wavelengths are much longer, and so do not affect our eyes.

Similarly, at the short-wave end of the scale we have first ultra-violet, then X-rays, and then the very short gamma-rays. Most people are familiar with the ultra-violet lamps used in hospitals, and surely everyone must know the value of medical X-rays. All in all, visible light represents a very tiny part of the whole range of the electromagnetic spectrum.

Tuning in the Milky Way

Before 1930, astronomers were to all intents and purposes limited to studying visible light from beyond the Earth, which was rather like the plight of a pianist trying to play a piece of dance music upon a piano which has no notes except those of the middle octave. Then, partly by accident, radio astronomy was born; radio waves from the Milky Way were picked up by an American engineer named Karl Jansky, who was studying 'static' and had not the slightest idea that he was about to make a sensational discovery (which, for some curious reason, he never really followed up). Some kinds of radio waves can come through the atmosphere. But – and this is the point – the upper air blocks out most of the rest of the electromagnetic spectrum. Infra-red radiations can be picked up to some extent, but X-rays, for instance, cannot.

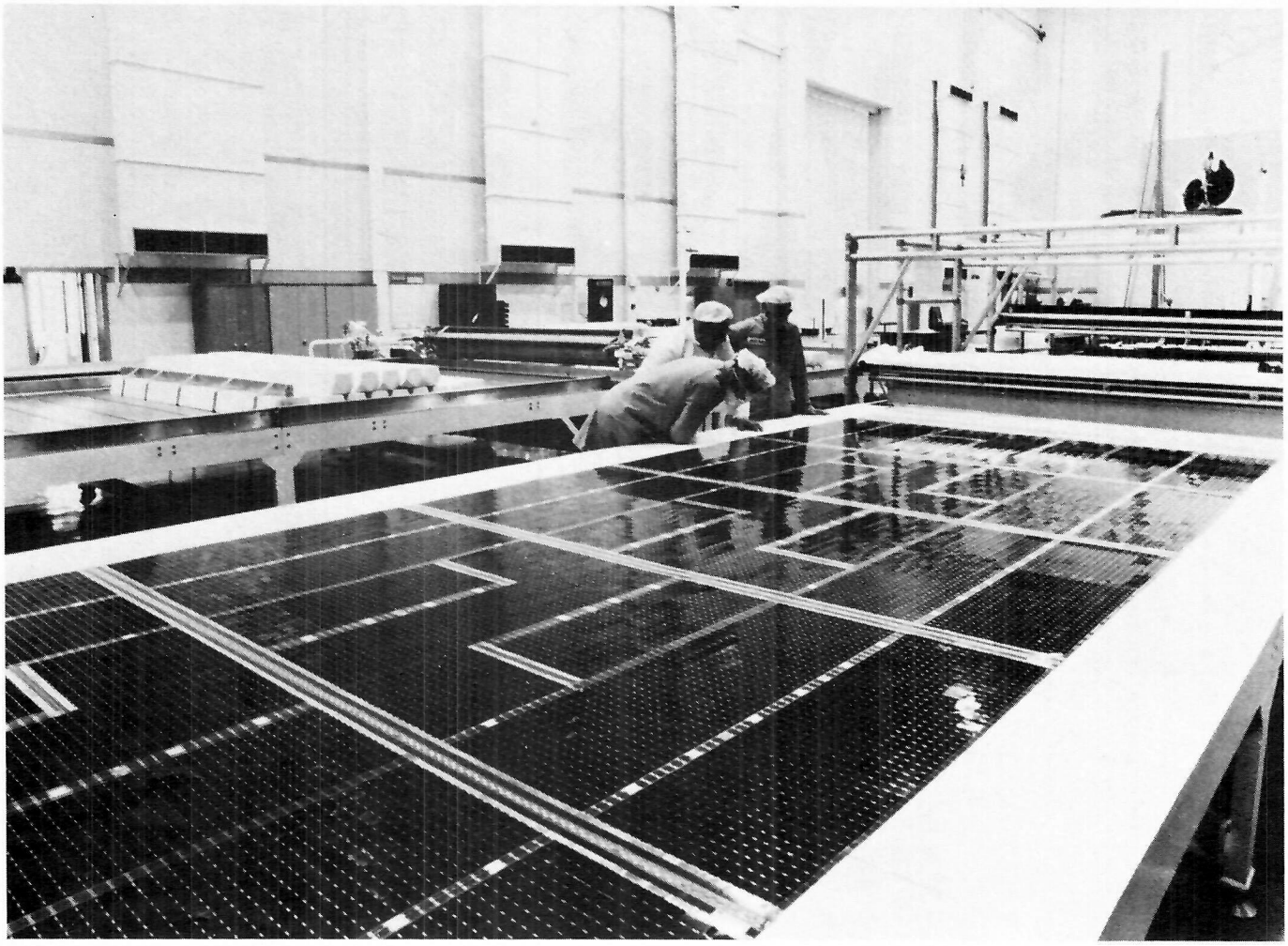
Before passing on let us also note that with optical telescopes a larger light-collecting mirror will be subject to a greater degree of disturbance from the atmosphere. At present the world's largest telescope, built by the Russians, has a 236-inch mirror. Frankly it has not been a success. The quality of the mirror may well be poor, but no doubt the atmospheric disturbance has something to do with it. The second largest telescope, at Palomar in California, is a 200-inch mirror, and has performed splendidly since it came into use in 1948 – in fact, it is much more powerful now than it was then, because is can be used with modern electronic devices which were quite unknown 30 years ago. But it is possible that 200 inches represents about the largest mirror which can be effectively used from solid ground; and there is also the problem of light pollution. Since 1948 the nearest cities to Palomar, Los Angeles and San Diego, have become larger and brighter. The skies at Palomar are not nearly so dark as they used to be, and for some fields of research the 100-inch reflector at Mount Wilson, overlooking Los Angeles, has been put out of action altogether.

The obvious remedy is to 'go up', which is why most modern observatories are built on the tops of mountains. The highest of all is the observatory on the summit of Mauna Kea, a volcano in Hawaii. Unlike its neighbour, Mauna Loa, Mauna Kea is extinct (at least, we hope so!) and its top rises to about 14 000 feet. At this level the air is very transparent, and, in particular, most of the water-vapour in the Earth's air lies below. This is important, because infra-red radiation is absorbed by water-vapour. One of the first telescopes to be built atop Mauna Kea was UKIRT, the United Kingdom Infra-Red Telescope, which has been a great success. At 14 000 feet, only 10 per cent of the water vapour remains above.

It has been commented that Mauna Kea is 'half-way to space'. This may be a reasonable comment, but there are extra problems – for instance, some astronomers are badly affected by the thinness of the air, and nobody actually sleeps in the observatory; for rest periods everyone goes down to Hale Pohaku, lower down the volcano at just below 10 000 feet. Yet even this is not a complete remedy. Mauna Kea is no use to X-ray astronomers, for example. The only solution is to go much higher than the top of any mountain peak. X-ray astronomy is a case in point. It had long been thought that some kinds of objects in space must send out X-rays, but until 1963 there was no proof. At that period rockets had become valuable scientific tools, and, of course, the first artificial satellites had been launched. It was an experimental rocket of 1963, carrying an X-ray 'telescope', that made the vital discovery. There are indeed X-ray sources in space; today we know of many thousands of them, and special X-ray satellites have been launched. One of these was the Einstein Observatory, which was launched in November 1978 and continued to send back data until the spring of 1981. It was 21 feet long, and moved round the world at a height of about 500 miles above the ground.

Glancing at X-rays

An X-ray 'telescope' is quite unlike an ordinary telescope, because X-rays will penetrate so many materials. The telescope makes use of what is termed 'grazing reflection' in which the incoming radiations are, so to speak, skimmed off the surface at a low angle, much as a flat stone will do when bounced across calm water in the familiar game of ducks and drakes. After being collected, the X-rays passed down a gold-plated tube into special detectors, where they could be analysed and the results transmitted back to earth. One object studied by the Einstein Observatory was a star-system known as Cygnus X-1, made up of a very massive star together with an invisible companion which is believed to be a black hole – a very massive, collapsed star now pulling so strongly that not even light can escape from it.



Deployment tests on the Space Telescope solar array. The array will power the telescope during its five year initial life in orbit. The 48,760 solar cells will provide 5 kilowatts of power at 34 volts. Photo: British Aerospace.

Despite UKIRT, infra-red astronomy also depends largely upon 'telescopes' carried in rockets and, today, in satellites. The latest infra-red satellite has been IRAS, the Infra-Red Astronomical Satellite, which was launched in Janaury 1983 and continued to function until November. It carried out a survey of the whole sky at infra-red wavelengths, and detected many thousands of new sources – as well as locating several comets, plus a remarkable small member of the Sun's family which can move in to a distance of a mere 9 000 000 miles fom the solar surface. Infra-red telescopees are more 'normal' than those built to study X-rays, but they have to be kept very cold, because otherwise the infra-red from the sky will be swamped by the 'heat' from the surroundings and even of the telescope itself. Liquid helium, the coldest liquid of all, has to be used, and IRAS ceased to operate only because the supply of liquid helium ran out. However, IRAS is still moving round the Earth, and there is at least a possibility that at some stage a maintenance crew will go out to it and put in some more liquid helium.

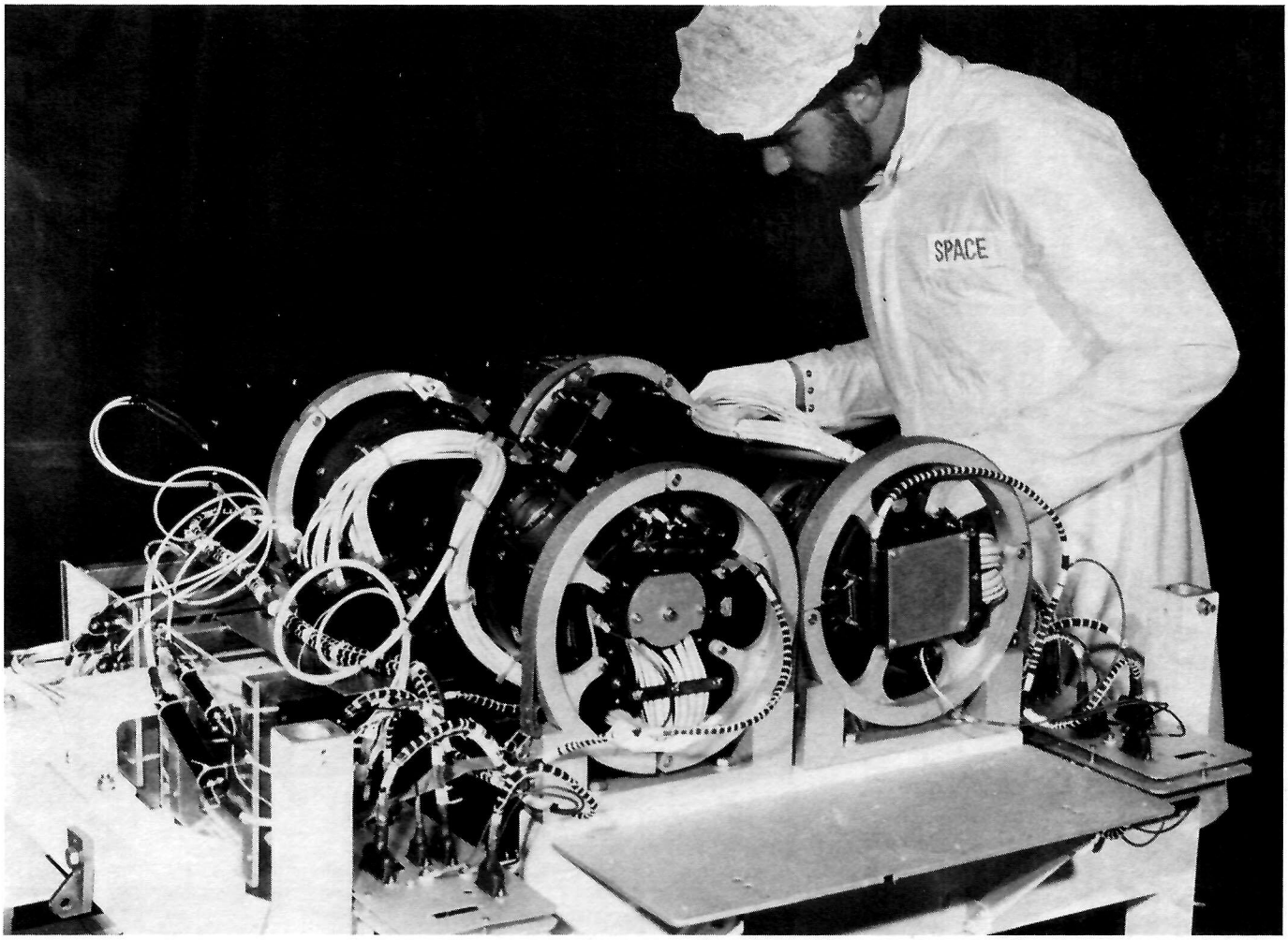
But despite all these developments, we must not neglect what used to be regarded as 'ordinary' astronomy: that is to say, the study of visible light. And here there are to be some startling developments in the near future. In fact, there have already been manned telescopes in space. The US station Skylab of the 1970s was manned by three successive crews, and a great deal of astronomical research was carried out, notably with regard to the Sun. From Earth, the blinding light of the solar surface masks the outer atmosphere of the Sun (except during the rare occasions when the Moon covers the Sun at a total solar eclipse), but this difficulty was removed when Skylab was used, and it is not too much to say that our knowledge of the Sun was increased tremendously. But the Space Telescope now being built, and which will – if all goes well – be launched in 1985, will be of a completely different class. It will be a reflector with a mirror 94 inches in diameter. Less than half a century ago there were only two telescopes larger than that: the Mount Wilson 100-inch and the Palomar 200-inch.

Altitude considerations

The height of such a telescope has to be carefully chosen. Coming too low means entering the uppermost layers of the Earth's air, thereby setting up friction and causing all kinds of problems. (There is no definite limit to the atmosphere; it simply thins out until the density is no higher than that of interplanetary space, but above a certain definite altitude it may be neglected.) There are also the Van Allen zones of radiation which surround the Earth, and which also most be avoided.

The Space Telescope will be a 'free-flyer', not connected to any satellite or space-station. Of course it will be controlled automatically by astronomers on the ground, but by now this is not likely to present much of a problem; there has been extensive practice with instruments aboard such vehicles as Einstein and IRAS, and the equipment can now be pointed very accurately indeed. Another advantage is that the Space Telescope will be in use for most of the time. There are no clouds to block its view, and no problems from mist or fog – or from artificial lights.

But the main advantage, of course, is that there is no over-lying air to block out any incoming radiation or to produce unsteadiness. Stars will not twinkle; they will be hard, sharp, unwinking points. Seeing will be perfect all the time. That being so, it follows that the Space Telescope should be much more effective than any telescope built on the ground – or, for that matter, any ground telescope which is expected to be built in the foreseeable future. It will be able to 'look' further into space, and study objects much too faint to be seen from Earth itself. At present the most distant object known is a quasar, around 13 000 million light-years away. Quasars are super-luminous, and may shine as brightly as a hundred whole galaxies of stars; it is now thought that they may be the centres of very active galaxies, powered by black holes. Also they are racing away at tremendous speeds; in



The Space Telescope's photon detector, developed and manufactured for the European Space Agency by British Aerospace. It can detect individual photons of light – a photon is a tiny packet or corpuscle of light energy. Photo: British Aerospace.

the case of the remotest quasar at well over 90% of the velocity of light. Generally speaking, it is a rule that the further away a galaxy is, the faster it is flashing away from us, so that the whole universe is expanding. It may be that an object at around 15 000 million light-years will have a velocity equal to that of light (186 000 miles per second), in which case we cannot see it, and we will have come to the boundary of the observable universe, though not necessarily the boundary of the universe itself. (I am sure that you will know what is meant by a light-year. It is the distance travelled by a ray of light in one year: rather less than 6 million million miles).

Ground-based telescopes cannot penetrate to such a distance – at least they have not so far succeeded in doing so. The Space Telescope may give us an answer, in which case we will have made an advance more important than any during the past century at least. There is also the exciting possibility that the Space Telescope will be able to show planets around some relatively nearby stars. One faint red star, Barnard's Star (named in honour of its discoverer, the American astronomer E E Barnard) is a mere 6 light-years away, closer than any other star apart from the Sun and the three members of the southern star-system of Alpha Centauri. Slight 'wiggles' in the movements of Barnard's Star have led to the suggestion that it may be attended by at least two planets. The Space Telescope may tell us.

What about maintenance? Telescopes are apt to go wrong; moreoever, the mirror of the Space Telescope is bound to be affected by interplanetary 'dust', as well as the chance of being struck by solid bodies known as meteorids. A collision with a large object, say the size of a writing-desk, would be fatal; luckily this is not probable, and the main trouble will come from much smaller missiles pitting the mirror. It is estimated that the Space Telescope will have an active life of at least 20 years. But by that time, it should be relatively simple to send up a technical crew to repair any damage. It may even be feasible to bring the Space Telescope down, overhaul it and then re-launch it. Anything of this kind would have seemed sheer science fiction not so long ago; I well remember the time when the whole idea of flight beyond the atmosphere was dismissed as a crazy dream. Now we can look further ahead – to telescopes on the Moon.

Unlimited telescopes

The Moon has no atmosphere, and its gravity is much weaker than ours; on the Moon an astronaut has only one-sixth of his Earth weight. Equipment will be so much less 'heavy' than it is on Earth that it will be easier to handle, and there seems to be no theoretical limit to the size of telescope which can be built. Radio astronomy may benefit to an even greater extent. Radio telescopes on the Moon can be used in conjunction with those on Earth, a quarter of a million miles away. Moreoever, it may be wise to set up a radio telescope on the far side of the Moon, which is always turned away from the Earth and is therefore shielded from all commercial and military radio signals. Radio interference like this is fast becoming a nightmare to radio astronomers; indeed, not so long ago Professor Sir Bernard Lovell, who probably knows more about the subject than anybody else, told me that unless some solution could be found, radio astronomy might be a science limited solely to the second half of the twentieth century. But a radio telescope erected on the Moon's far side will be operating in conditions which are completely 'radio quiet'.

These, then, are some of the possibilities. Who knows what will happen before the year 2000? There should be elaborate space-stations, equipped with astronomical instruments; there will be more free-flying Space Telescopes, and possibly obervatories on the Moon. But all this depends upon one thing: full international collaboration. This is perhaps not too much to hope. And it is certainly quite on the cards that some of you now reading this article will be able to get into space and see for yourselves.

THE OUTERSPACE CONNECTION

THIS CONTROVERSIAL NEW HOME VIDEO RELEASE CLAIMS THAT WE ARE NOT ALONE ON MOTHER EARTH. HAS E.T. BEEN HERE ALREADY AND LEFT EVIDENCE OF HIS VISIT?

Men (and presumably women) have looked at the stars in wonderment from time immemorial – even before 'The Sky at Night' started. Whilst we've learnt an enormous amount about the planets, stars and galaxies that surround us, the one fundamental question left unanswered is – is there anyone out there? If there is another civilisation living on a planet circling a star in our or another galaxy, perhaps one day they may visit us (or vice versa). Perhaps they have already.

There's no perhaps about it as far as the producers of 'The Outerspace Connection' are concerned. This slick American production, now available to UK television viewers on video, starts off with the sweeping statement that 'They have been to Earth and left their mark in many ways and many places'.

That sets the scene – extra-terrestrials have been here, no doubt about it. Not only that, but writings found in ancient stone tablets are said to predict the day when the aliens will return to Earth to stay. As evidence for the visitors from outer space, the narrator (Rod Sterling) cites the case of the strange lines, animal drawings and patterns in the Nazca desert in Peru. Barely discernible from the ground, they were made by the Nazca indians who cleared the desert's top layer of dark stones in places to reveal lighter soil underneath.

The obvious question is, why should a primitive indian community make these huge landscape drawings if they can only be seen from the air. The Outerspace Connection jumps enthusiastically to the conclusion that the drawings must have been inspired by, and intended to be seen by, visitors from the sky. That's quite a jump in reasoning.

In the book, 'Arthur C Clarke's Mysterious World', when faced with the same puzzle, the author suggests a simpler explanation. Ancient man believed that he could see gods in the shapes of animals in the stars – hence the modern names we have for the constellations. Ensuring a good crop next season or a successful hunt for meat meant keeping the gods happy. Ancient man therefore surrounded himself with the images of the gods and performed elaborate rituals to bring good fortune. These huge and impressive images drawn across the landscape, not only in Peru but at sites all over the world, were perhaps labours of worship to be seen by the sky gods, the stars.

Other researchers have established that the Nazca lines are not an ancient astronomical calendar. Moreover, the video does not explain that there is a tradition amongst the native people of building stone shrines linked by straight paths – perhaps this is a simpler explanation for the Nazca lines.

Ancient life force

In the video, a hand from an Egyptian mummy is said to contain a spark of life that is still detectable after the intervening 20 centuries, perhaps the last vestige of the life force? This is demonstrated dramatically as a blue lightning-like aura radiating from the hand, which is subjected to the 'Kirlian effect'. The Kirlian effect is simply a means of exposing an object to a very strong electromagnetic field. The effect produced can be captured on film. It shows the interaction between the object and the field. Although the video only shows results obtained by using live or previously live subjects, auras are also produced by objects which have never lived – a door-key, for example, can be made to show this 'spark of life'.

Radio signals received from space in 1927 have been interpreted by Duncan Lunan of the British Interplanetary Society as a coded message from an alien space probe. He has decoded the message to reveal the origin of the probe. Although he doesn't explain how he decoded the message (he merely states it as a fact), the concept of labelling probes with data isn't new. We've done it ourselves. Pioneers 10 and 11 both carried star maps showing where they came from.

If the transmissions received in 1927 really did come from a probe, then it may be travelling in the solar system now monitoring the planets. The video goes on to claim that 'bogeys' or UFOs reported by American astronauts may be sightings of this probe. Astronauts have repeatedly denied any encounter with 'flying saucers'.

Earth colony

Earth-base 1, where space colonists are said to have first landed, is identified as a location on the shores of Lake Titicaca in modern Bolivia. The region is named after a geographical oddity which is only visible from space. How did the ancient inhabitants of the area see or hear of something only visible from space? Stone carvings in the area are described as 'clearly' showing astronauts wearing space helmets.

The Outerspace Connection does turn up some interesting puzzles, but you'll have to watch it for yourself to find out what they are. In conclusion, I felt that The Outerspace Connection follows the well worn path of offering alien encounters as the only or the most likely explanation for puzzling events in the remote past, but with little or no supporting evidence, or even an attempt to exclude conventional explanations. There are indeed mysterious occurrences which modern science has not yet explained. You must judge for yourself whether or not you accept The Outer Space Connection's contention that these events must therefore prove that aliens have already visited the Earth and will soon return for good.

The Outer Space Connection (91 minutes running time) is distributed by Video Program Distributors Ltd, GEC Estate, East Lane, Wembley, Middlesex HA9 7FF and should be available from your local video dealer.

FEUDAL LORDS

For the first time the 20th century micro computer offers a 9th century game. FEUDAL LORDS is a computer moderated play by mail game of economic, political and military con-flict in a semi-mythical England in the age of Arthur. Up to 15 player controlled Fiefdoms with Peasants, Knights, Livestock, Castles, Markets and Mines cooperate with each other (or fight against each other—some-times both at the same time) to put one ambitious Baron or Baroness on the vacant Throne of England.

FEUDAL LORDS is a strategic level game where turns are measured in Years and armies go home after fighting a battle. The game is not simple and will require all the skill and daring of a would be King or Queen.

Someone like yourself perhaps?

For further details send a SSAE to ICBM or better still buy the rules for 50p. Please don't ask to enter a game until you've read the rules. FEUDAL LORDS costs £1 a turn plus a SSAE.

ICBM, P.O. Box 94, Bath Street, Walsall, West Midlands.

THE MORROW PROJECT

THE MORROW PROJECT is a set of rules and scenarios for man to man combat, using 20th century weapons in a world 150 years after a Nuclear War.

The rules contain probably the most realistic and detailed information on weapons systems yet seen on a man to man scale. Whether it be Claymore Mines, Armbrusts or Atchisson Machine shotguns all the detail is there. The combat rules cover everything from being hit by a Thermit grenade to a wooden club.

The MORROW PROJECT rules themselves have been amended and expanded by the MORROW PROJECT ROLE PLAYING SUPPLEMENT and the first scenario ready for instant play, THE LIBERATION OF RIVERTON is now in print. *(Dice not supplied.)

TMP can be played as an infantry combat game or a futuristic role-playing game, or both.

A convention dedicated to the game system is to be held in Walsall in April 1984.

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SHUTTLE UPDATE

IN A PROJECT DEMANDING THE CLOSEST CO-OPERATION YET BETWEEN ESA AND NASA, SPACELAB-1 HAS GUARANTEED EUROPE A PLACE IN THE FUTURE OF MANNED SPACE RESEARCH

On November 28th 1983 Europe joined the big league of nations in manned space flight. As the Space Shuttle Columbia prepared for launch, the European manned orbiting laboratory Spacelab-1 nestled in its payload bay. Once in Earth orbit, the payload bay doors would open and expose the laboratory and some of its experiments to the vacuum of space.

The space station is a dominant feature of many a space fantasy. It's the jumping off point from one planet to its neighbours or to the stars, a scientific observing and experimentation platform par excellence and, regrettably, it is still seen by some as the classic military 'high ground'. Whilst streamlined shuttle craft ferry people and materials from the planet's surface to the station, the spacecraft which utilises the deep space side of the station need not make any concessions to aerodynamics. They need never descend into a planet's atmosphere.

Such a sophisticated system as the enormous spinning wheel familiar to filmgoers in 2001: A Space Odyssey is certainly still fantasy, but both America and the Soviet Union have been experimenting for some years in the techniques necessary to build and maintain a permanent station in near-Earth space . . . and now Europe is getting in on the act. In 1969, NASA invited Europe to participate in America's Post-Apollo Programme, and in the next year the European Space Conference authorised studies which included orbital systems. In 1972, the seeds of Spacelab were sown when the European Space Research Organisation (ESRO) was charged with the task of studying the development of an orbiting laboratory. In 1973, ESRO became committed to Spacelab as an integral part of the Space Shuttle transportation system. The orbiting laboratory would be carried into space in the Space Shuttle's cargo bay. The division of responsibilities was basically that NASA would build and initially operate the shuttle, and ESRO would built Spacelab and all the equipment associated with it. The two organisations agreed specifications for the hardware and a timetable for development and manufacture. In 1975, ESRO was re-organised and re-named as the European Space Agency (ESA). Throughout the 1970s, work on both sides of the Atlantic quietly gained momentum as both ESA and NASA asserted their long-term

Inside Spacelab's pressurised module, Dr Ulf Merbold (left) trains on the fluid physics module at the Kennedy Space Centre in Florida. The white overalls are worn to keep dust out. Photo: NASA.

committtment to the project. Spacelab represents an investment of around a billion US dollars, with West Germany providing most (55%) of the funding.

Spacelab is modular in design. That is, it isn't a single unit, but a series of building blocks that can be assembled according to the requirements of a particular mission. The two major components of the system are a pressurised module and an open pallet. The pressurised module looks rather like a large soup can on its side. Inside, it provides a shirt-sleeve environment for scientists to work in comfort. Even this can be split up and rebuilt to form 'soup cans' of different sizes for various mission requirements. The pallet is a platform on which experiments can be mounted and which is open to the vacuum of space.

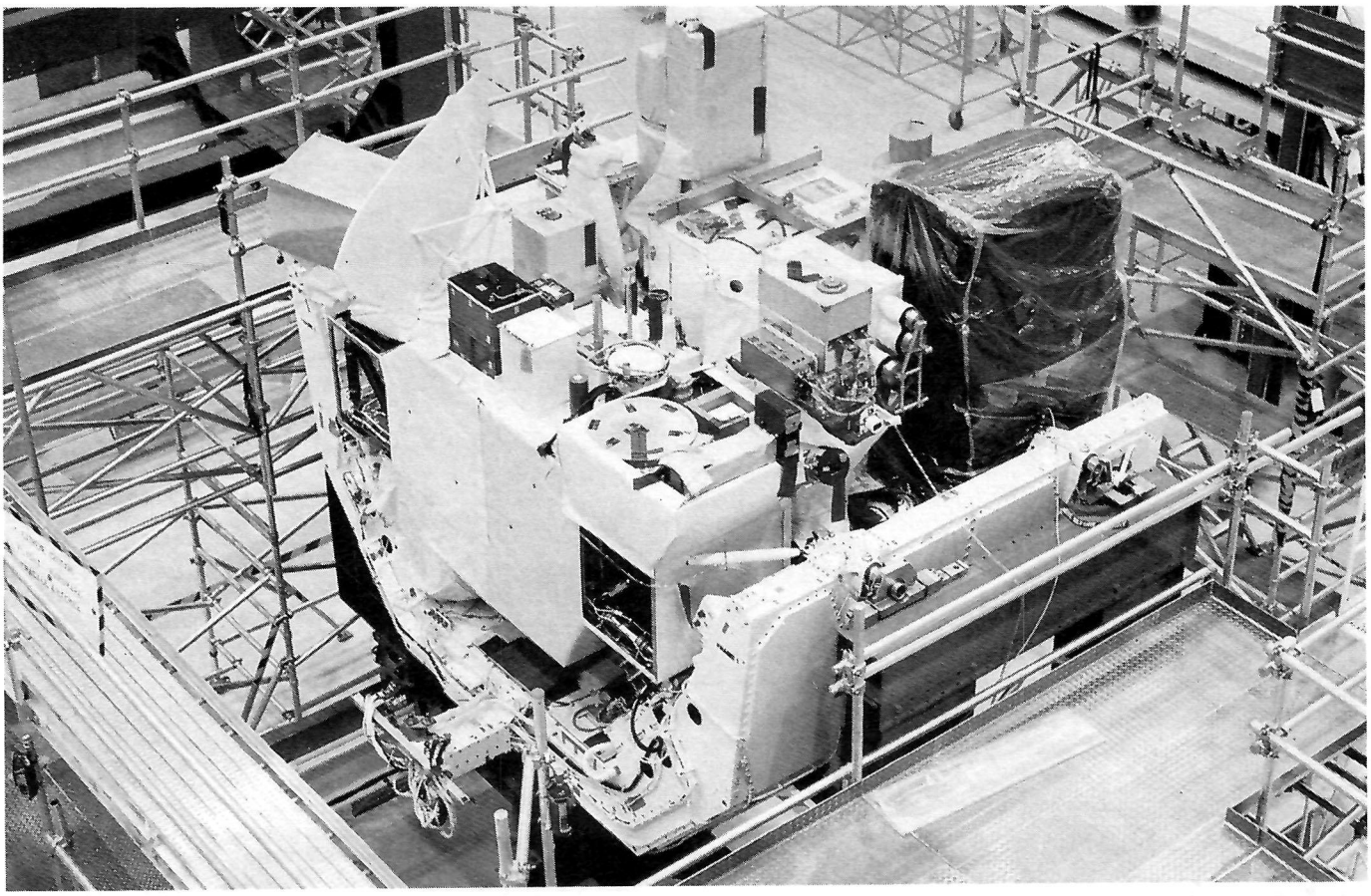
As in the case of the Space Shuttle that carries it, Spacelab is re-usable. The pressurised module is intended to last for 50 flights of seven days each, although longer flights (up to 30 days) are on the drawing board. That gives the module a lifespan of around ten years, given a realistic launch schedule. Inside, the module is lined with a very versatile array of instrument racks, which can be removed and fitted with the control and instrumentation hardware required for a particular mission. They are then simply slid into place in the empty module. Many of the essential power, avionics and life support systems are hidden away underneath the module's false floor.

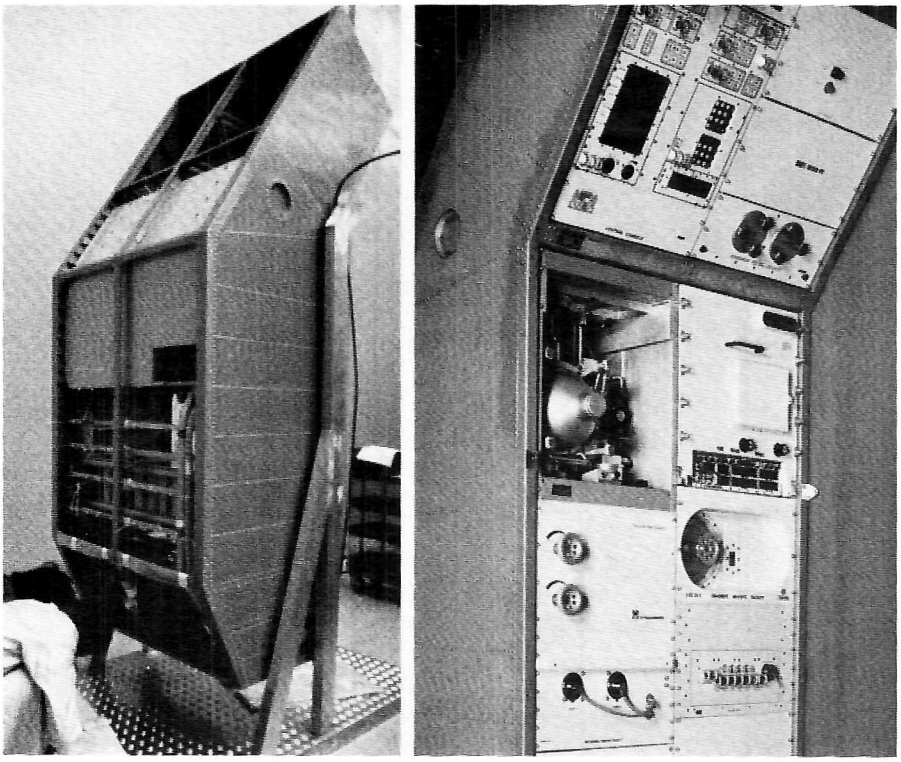
Outside the module, but still within the Shuttle's cargo bay in the cold silence of space, sits the experimental pallet. Like the pressurised module, this too consists of a series of separate components, so that pallets of different sizes can be constructed to match the needs of a particular mission. Normally, all the systems necessary to support whatever the pallet is carrying are housed inside the pressurised module. However, in several configurations the pressurised module will not be flown. In this case the pallet's support systems are housed in an 'igloo', a large cylinder attached to the pallet.

Why send men?

Now what of the human element, the Spacelab crew? Before talking about what these 'payload specialists' actually do, perhaps I ought to address myself to the question of whether scientists need to go into orbit at all? It's a question which has divided opinions for years. Some commentators hold that the successes achieved in remote sensing and automatic experimentation prove that human

Experiments requiring direct exposure to space are mounted on the U-shaped pallet. These experiments were photographed during final assembly at the Kennedy Space Centre. Photo NASA.





The racks (botton left and right) which line the pressurised module provide a versatile support structure for a wide range of control, life support and experimental hardware. Photo NASA.

The European experiments carried aboard Spacelab-1.				
DISCIPLINE	NUMBER OF EXPERIMENTS	PARTICIPANTS	INSTRUMENTS	LOCATION
Life sciences	10	Germany, France, UK, Italy, Sweden, Switzerland, USA	Vestibular sled, cell transplants	Pressurized module
Atmospheric physics	3	Germany, Belgium, France	Telescope spectrometer	Pallet and Pressurized module
Solar physics	2	Belgium		
Plasma physics	3	Germany, Austria, France, Norway		
Astronomy	2	Germany, France, UK, Italy	Infrared telescope, microwave experiment	Pallet
Earth observation	2 instruments	Germany	Metric camera, Microwave instrument	Pallet
Materials science	40	Germany, Austria, Belgium, Denmark, Spain, France, UK, Italy, Sweden, Netherlands	Isothermal furnaces and both gradient and mirror-type furnaces, fluid physics module	Pressurized module

Some of the 'gee-whizz' figures relating to the Space Shuttle's propulsion system.

BOOSTERS:	Unit mass	—	584	Tonnes
	Thrust (each)	—	11,800,000	Newtons
ORBITER:	Thrust per engine (in vacuum)	—	2,100,000	Newtons
	Thrust per engine (on ground)	—	1,700,000	Newtons
	Total Shuttle thrust (lift-off)	—	28,700,000	Newtons

intervention is not necessary. After all, if you can send a laboratory to Mars, land it, start it up and monitor its experiments successfully, then you ought to be able to do that and more in Earth orbit on the back of a manned spacecraft (the Space Shuttle).

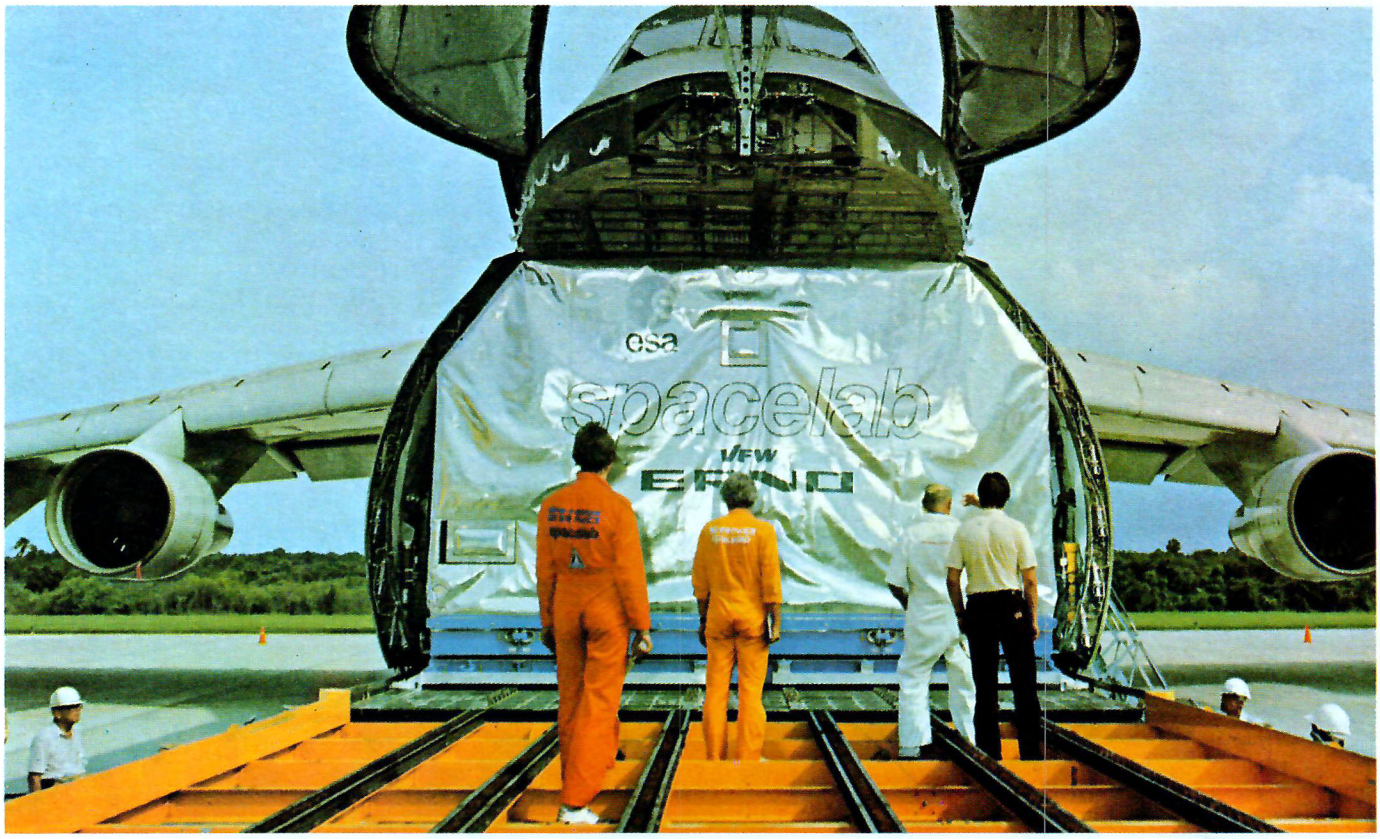
The main attraction of a Shuttle-Spacelab combination is that the crew-members who operate the laboratory (the payload specialists) are not the Shuttle's flight crew. Spacelab can, therefore, be managed by people who are primarily scientists, not test pilots or military jet jockeys. The payload specialists can get on with doing some active science without having to know anything about how to fly the Space Shuttle. The function of the payload specialist is to assemble, operate, monitor and if necessary re-align or re-calibrate Spacelab's experiments. He (or she) is the eyes and ears of the scientists who designed the experiments – changing test specimens, re-calibrating instruments, carrying out minor repairs and seizing opportunities that an automatic experiment would miss. Moreover, it's much easier to design an experiment to be operated by a trained scientist than it is to produce an automatic experiment. The Shuttle crew and Spacelab payload specialists may even have to act as the subjects for life science experiments. The success of Spacelab-1 has converted many of those who doubted the value of sending scientists into space.

The crew on each Shuttle-Spacelab mission typically comprises six members, fulfilling three distinct functions. The Shuttle Orbiter is flown by the commander and pilot, both from the Astronaut Corps at the Johnson Space Centre in Houston, Texas. Two mission specialists, also provided by the Johnson Space Centre, take care of the Orbiter systems that support Spacelab. They control the link between the Orbiter and the laboratory. That leaves the two payload specialists on-board Spacelab to manage everything inside the laboratory. The payload specialists must be intimately acquainted with the experiments carried on each mission in addition to the Spacelab command, data and life support systems common to every mission.

Spacelab-1 has caused quite a stir even amongst hard-nosed NASA veterans. It has been described as 'a turning point' and 'an extraordinary success'. Derek Mullinger, British head of the team that integrated the European experiments in the Spacelab payload, said that the mission had generated 'more data than they (the scientists) would have believed possible.' He went on to say that one of the greatest benefits of the Spacelab mission was the ability of the scientists on board to modify experiments in mid-course and to do previously unplanned experiments as the results of earlier work became known. At one briefing, a NASA official said that he had 'never seen a system as accurate, complete and problem-free' as Spacelab – praise indeed from an organisation that's been involved in the spaceflight business for more than 25 years. So, let's take a closer look at the first mission of this European high-flier.

Spacelab-1

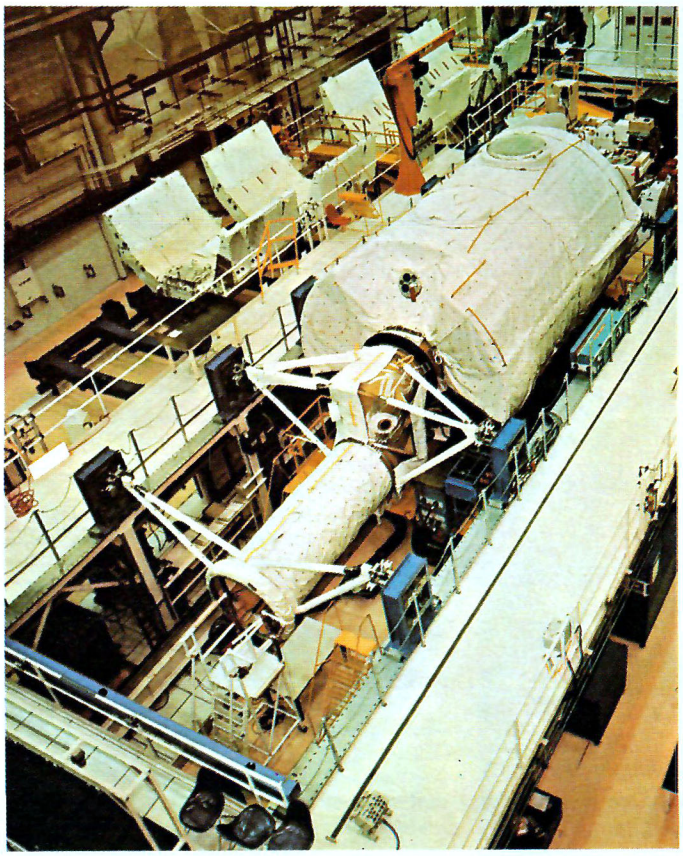
Until mid-October 1983, everyone at the Cape (Cape Canaveral) was confidently looking forward to an October 28th launch. However, some worrying news about the solid rocket boosters (SRBs) used on the previous flight

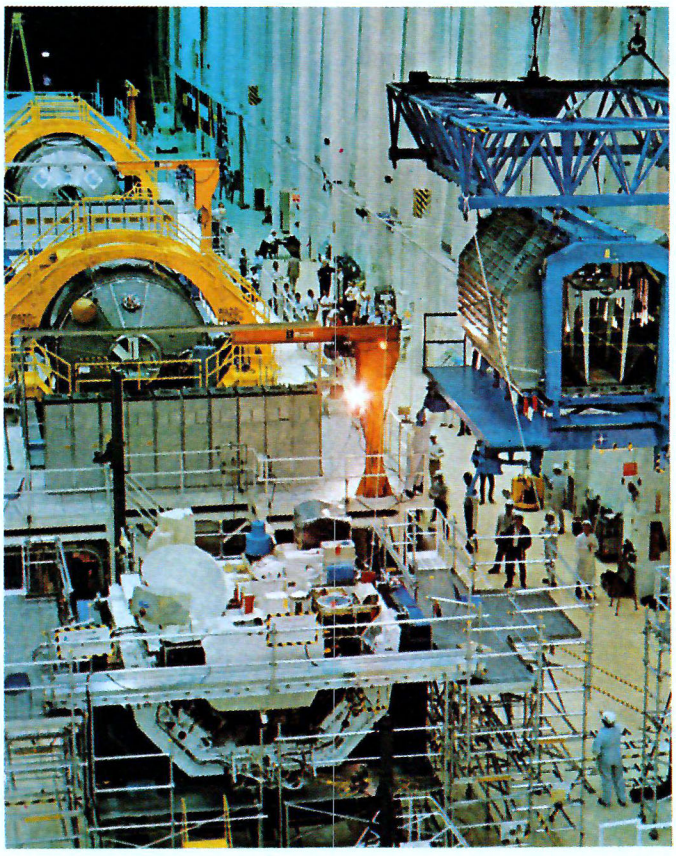


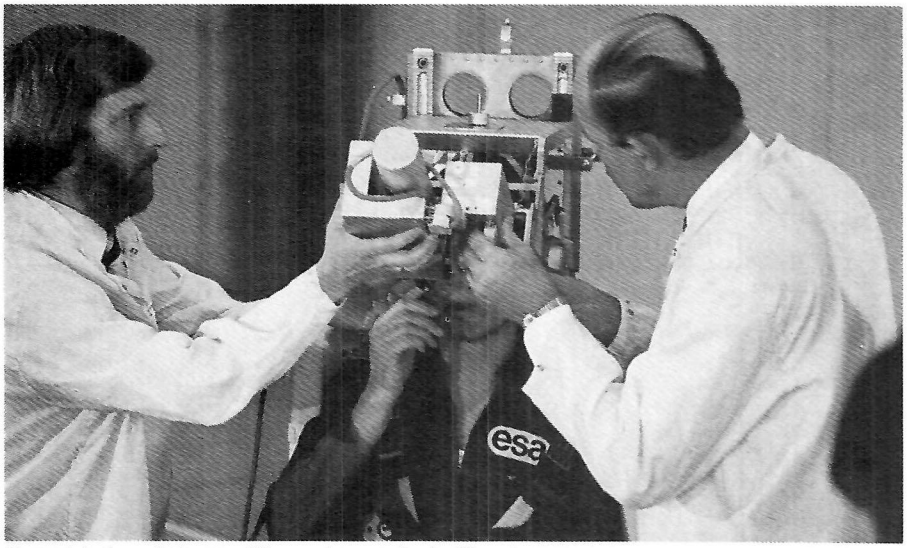
Above: Before its flight in Space, Spacelab-1 was transported end of 1981, beginning of 1982 over the Atlantic for delivery to NASA, responsible for the integration into the Shuttle Orbiter and for operations in orbit. Photo NASA

Left: Integration and check-out of the combined Experiment equipment and Experiment mounting elements with flight sub-system support elements are practically completed.

Right: The assembly of the complete Flight Units occurs in the Operation and Check-out (O and C) building at the NASA Kennedy Space Center. During integration a number of tests are performed to verify all systems and interfaces are functioning properly and all Spacelab/payload elements are compatible. Photo's NASA

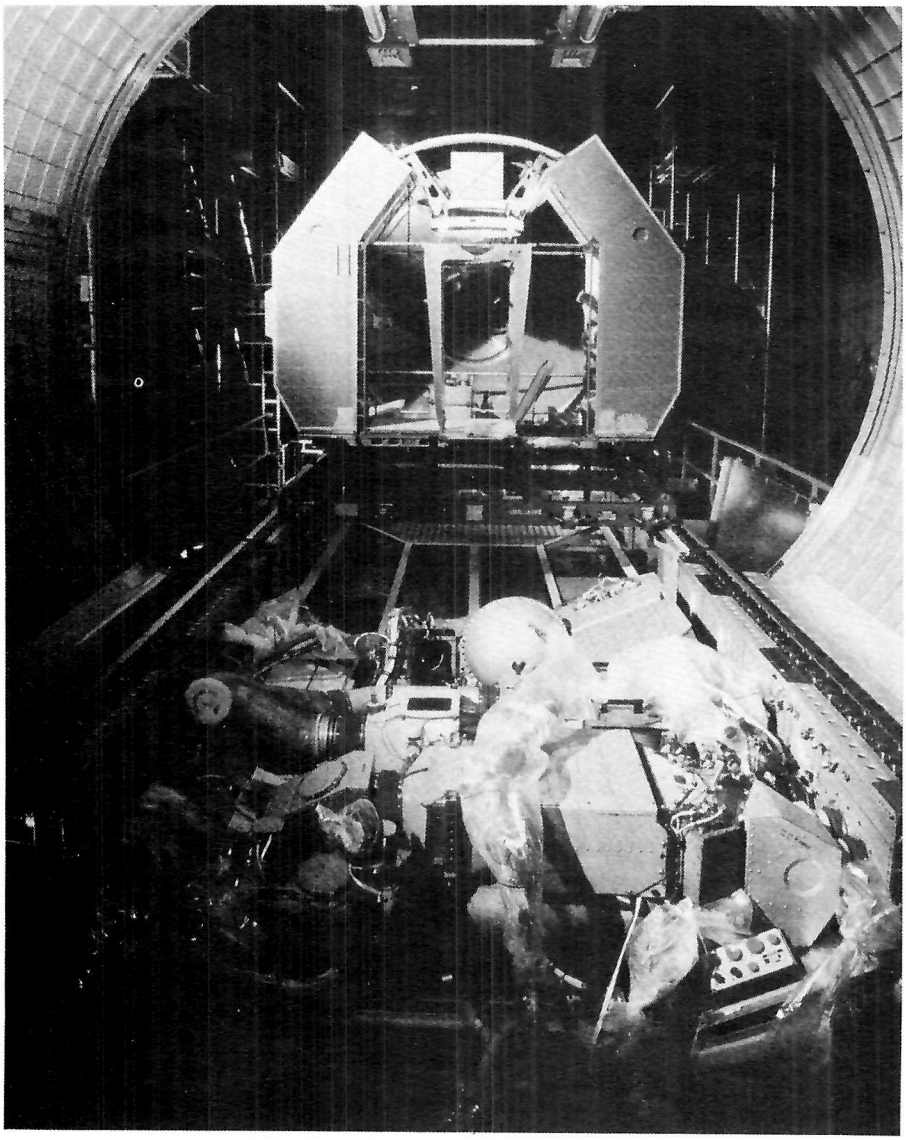






Spacelab-1 carried some 70 experiments. In the life sciences discipline experiment no 1, this helmet was used to investigate the vestibular functions (relating to balance) of the inner ear. Photo ESA.

A Spacelab kit! This is a moment from the construction of the flight unit module at MBB/ERNO in Bremen, West Germany. The main part of the life support equipment shown here is hidden under the floor of the finished module. The rails running along each side of the floor well allow instrument racks tailor-made for each mission to be slid into place. Photo ESA.



made a delay inevitable. One of the booster's liners showed abnormal deterioration. NASA understandably would not commit themselves to a launch date for the next flight until they understood exactly what had caused this problem.

The SRBs are the largest solid propellant rockets to be used for manned flight. Their thrust cannot be controlled like that of a liquid propellant rocket. Once they're fired, they burn until they run out of propellant, like gigantic versions of their diminutive firework relations. Like the Shuttle itself, they are re-usable. When all their propellant is exhausted they are separated from the Orbiter's external fuel tank by explosive bolts and fall back into the sea. They are then recovered by ship, refurbished and strapped onto the sides of another Orbiter-fuel tank assembly. Ironically, when John Young was selected to fly the Shuttle, he expressed the hope that he would not be the first astronaut whose Shuttle would be launched by second-hand SRBs. The SRBs used on the first Space Shuttle flight, commanded by John Young, were refurbished in time to be used on the ninth flight – the Shuttle that was to carry Spacelab-1, also commanded by John Young!

The delay allowed NASA to work on minor problems in the Orbiter, including a faulty fuel cell. Some of the astronomy experiments to be carried out by Spacelab depended on the Orbiter being in the right place at the right time. As a result of the delay, NASA and ESA have offered researchers whose experiments are adversley affected the opportunity of flying them again on future missions.

Some of the remaining experiments needed a maximum of orbit darkness time, restricting the launch window – the time during which the Shuttle can be launched. Other experiments called for a new moon late in the flight, a requirement that could not be met beyond December 5th. Safety also influenced the time and length of the launch window. An airfield at Zargoza, Spain, can be used in the event of an emergency landing, but it can only be used until 15 minutes after sunset. All these factors meant that the Shuttle could only be launched between 16.00 (GMT) and 16.14 between November 28th and December 5th, with the window 'closing' by a few seconds each day.

In the event, the Shuttle did get off the ground on the 28th, carrying a crew of six (the largest to fly aboard a single spacecraft) and the heaviest payload to date. It was also the first time a non-American had flown aboard an American spacecraft. Dr Ulf Merbold, a West German physicist became the first European payload specialist. The second payload specialist, Dr Byron Licthenberg, is a member of the research staff at Massachusetts Institute of Technology (MIT).

Three hours after launch the two payload specialists floated along a 1 metre wide crawlway, called the Spacelab Transfer Tunnel, into the laboratory. They then powered it up and checked on how well it had survived the acceleration forces and vibration of the launch. The crew worked in overlapping shifts, so that Spacelab could be operational 24 hours a day.

The full list of experiments is too long to catalogue here, but basically they fell into four broad categories – atmospherics, climatology, Earth science and astronomy. The crew themselves were the subjects of a series of experiments investigating space sickness. For-

Some of the Space Shuttle's vital statistics.

SHUTTLE:	Mass at lift-off	—	2000	Tonnes
	Length		56	metres
ORBITER:	Mass on landing	—	85	Tonnes
	Length	—	37	metres
	Wingspan	—	24	metres
	Height	—	17	metres
	Cargo bay length	—	18	metres
	Cargo bay diameter	—	5	metres

Spacelab funding throughout Europe.

GERMANY	53.3%
ITALY	18.0%
FRANCE	10.0%
UNITED KINGDOM	6.3%
BELGIUM	4.2%
SPAIN	2.8%
NETHERLANDS	2.1%
DENMARK	1.5%
SWITZERLAND	1.0%
AUSTRIA	0.8%

The European and American crew members of STS-9/Spacelab-1.

COLUMBIA CREW	
Commander	John Young
Pilot	Brewster Shaw
Mission specialist	Dr Owen Garriott
Mission specialist	Dr Robert Parker
SPACELAB-1 CREW	
Payload specialist	Dr Ulf Merbold
Payload specialist	Dr Byron Lichtenberg

tunately, it was found that these experiments could be carried out without making the crew too sick to continue working. Experiments in crystal formation may lead to the production of much more powerful computer chips.

These types of experiments capitalised on Spacelab's weightless environment, but others made use of Spacelab as an observation platform. Less than 30% of the Earth has been mapped in detail. Spacelab's metric camera took overlapping stereoscopic photographs of the Earth's surface with excellent resolution. They will be used to produce better maps of relatively unknown areas like the Amazon Basin.

The upper atmosphere was studied in detail. Observations of faint light emissions added to understanding of the dynamics and chemical structure of the highest regions of our precious atmosphere and how it is being affected by man-made pollution. Very little was previously known about this area of our air supply and shield against harmful ultra-violet radiation.

99.9% of the universe is in a plasma state – a plasma is an ionised gas. Instead of merely measuring the plasma passively as the Shuttle flew through it, the Orbiter actually fired beams of charged particles into the plasma and observed how it reacted. Other instruments measured the Solar Constant – the total energy output of the Sun. As variations of only a few tenths of a percent in the Sun's energy output can have significant effects on the Earth's climate, accurate Solar Constant measurements are very valuable indeed.

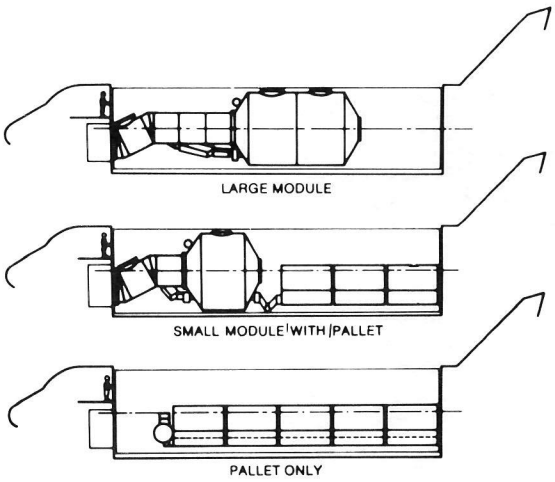
Ultraviolet and X-ray telescopes aboard Spacelab observed far-away astronomical objects more clearly than ever before. The X-ray telescope in particular confirmed something predicted by theory but never before directly measured – the presence of iron in neutron stars.

Running repairs

NASA and ESA officials and scientists were clearly very pleased with this almost perfect mission. With the exception of one experiment that should have used a microwave radar to study terrestrial weather and land features, all the scientific investigations on board achieved substantial returns. There were some problems with some of the experiments, but the crew spent a weekend repairing these. Despite the advanced technology involved, they did meet with some success. For instance, Dr Merbold repaired a defective mirror heating furnace. He took a section of it apart with a screwdriver and removed a defective cable that had short-circuited the furnace's power supply. If he had not done so, four crystal formation experiments that had taken years to develop would have been lost. According to NASA mission scientist, Dr Rick Chappell, around 90% of the mission's science objectives were accomplished.

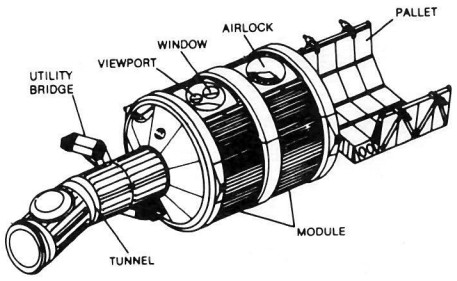
Owen Garriott, an amateur radio enthusiast, brought a ham radio with him on Columbia. Ham radio operators on Earth tried to contact Garriott as he passed overhead. One successful contact was made with King Hussein of Jordan.

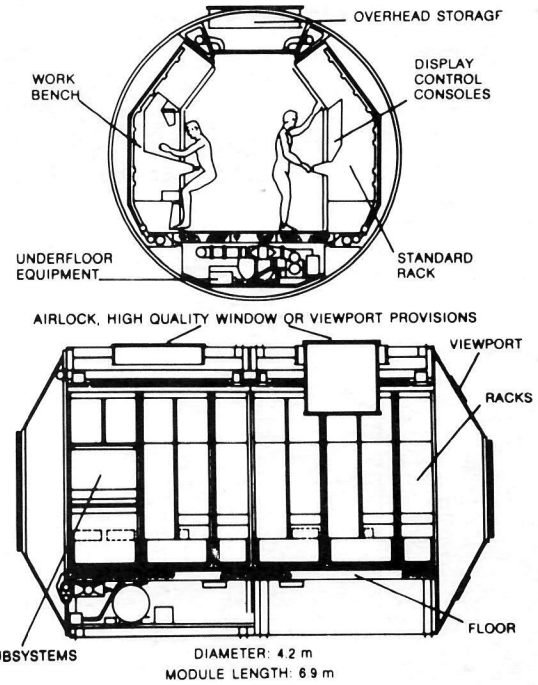
The mission went so smoothly and successfully that it was extended from nine to ten days, the extension being conditional on good weather reports for the landing site in California. The decision to go for an extension was made when it became clear that critical



Three typical Spacelab flight configurations in the Space Shuttle Orbiter's cargo bay.

Spacelab-1 was constructed from a long pressurised module (7 metres) and a single U-shaped pallet (3 metres long), connected to the Space Shuttle Orbiter by a crawl-way tunnel.





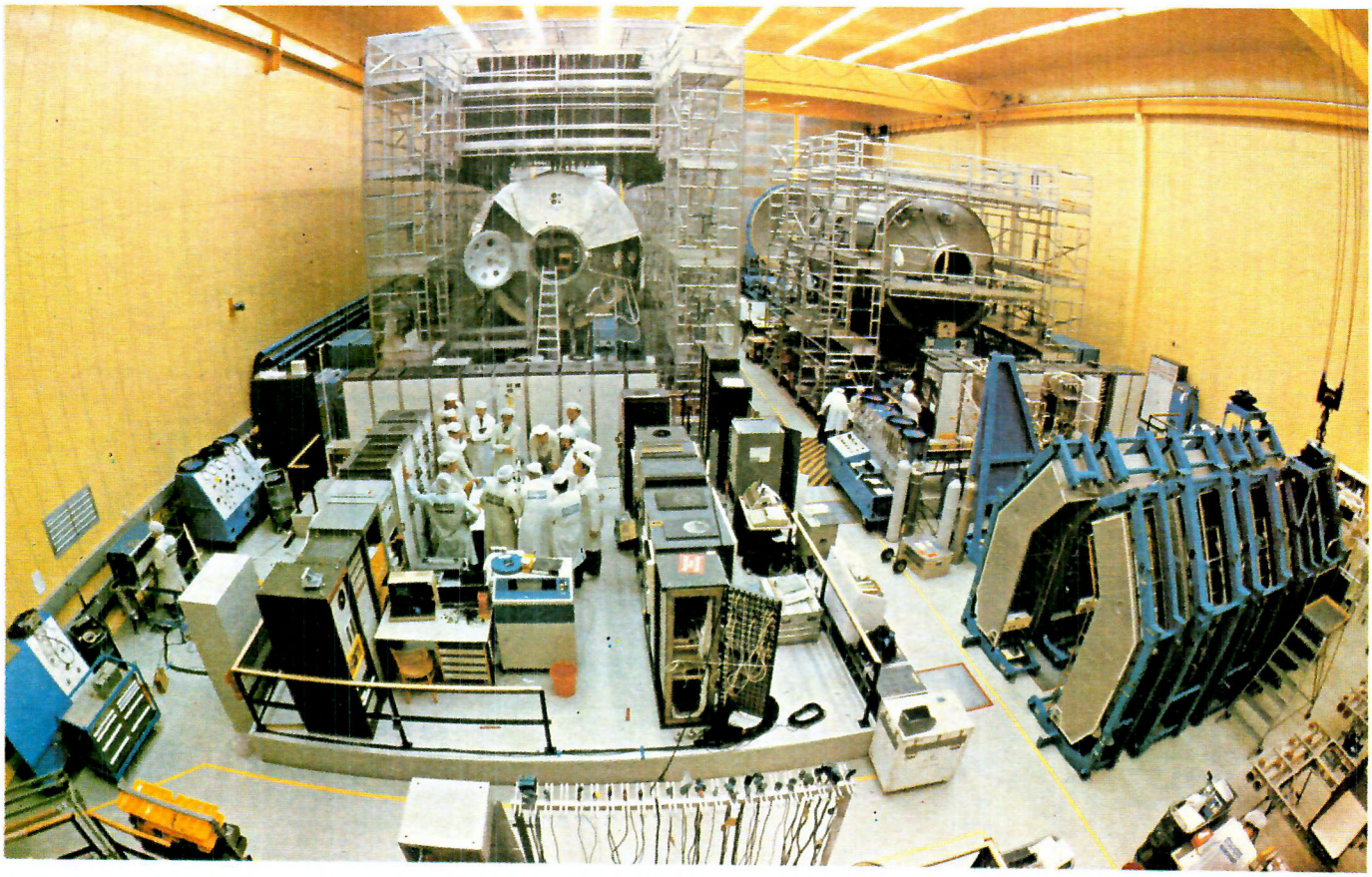
Two cross sections through Spacelab showing the lab's structure and giving some idea of the working space available to the payload specialists.

Orbiter supplies would easily support such an extension and that the scientific returns of the mission would be substantially increased.

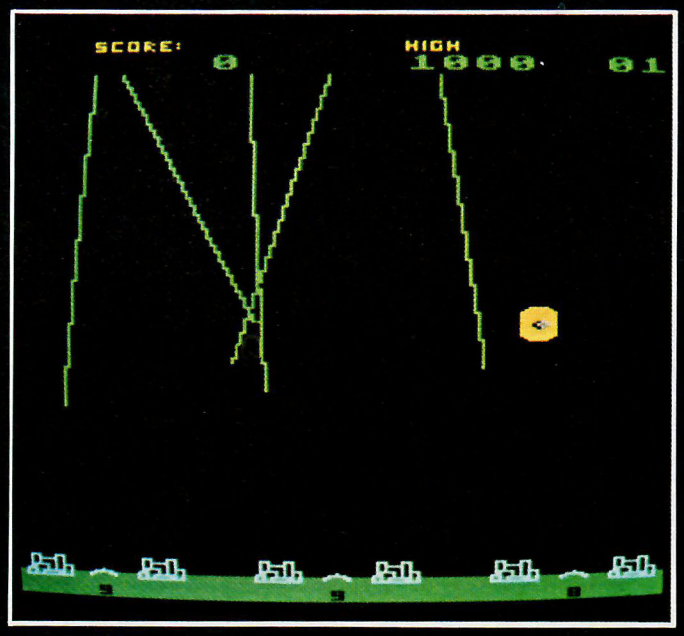
NASA officials are clearly impressed with the European laboratory and have expressed a wish to continue close co-operation. NASA must now decide what its next major objectives in space should be – perhaps a manned flight to Mars, perhaps a permanently manned orbiting laboratory. Reports suggest that Spacelab has ensured that ESA will play an important role in the development of larger orbiting structures. One European official is quoted as saying, 'It's not whether we will have a space station, it's when.'

NOTE: No single article can do justice to Spacelab, so from time to time Voyager will return to look at different aspects of the European orbiting laboratory, including the perennial favourites – space loos!

Below: Background left: the engineering model of the Module with its thermal shield. Right, the flight units: the Racks in the foreground, the Module in the background. Foreground left: the check-out equipment and the engineers from ESA and European industry who have worked here for some six years from the assembly of the hard mock-up in 1977 to the delivery of Spacelab-1 and 2. Photo B. Paris. Right: The two Payload Specialists are part of the four member science crew in the Spacelab-1 mission. Left, Dr Byron K. Lichtenberg (Massachusetts Institute of Technology), NASA, USA, specialises in biomedical engineering. Right, Dr Ulf Merbold (Max-Planck Institut, Stuttgart, Fed. Rep. of Germany) ESA, is a specialist in crystal lattice defects and low temperature physics. Photo ESA



Cylon Attack



Missile Base

MICRO WARS

IN THIS NEW REGULAR FEATURE, WE REVIEW A SELECTED SAMPLE OF SPACE GAME PROGRAMS FOR THE MOST POPULAR HOME COMPUTERS

All of the games programs featured in MICRO WARS should be readily available either from your High Street software shop or direct from the supplier, whose name, address and telephone number is given at the top of each review. Most of these programs sell for £5 to £10 and unless otherwise stated they are supplied on tape cassette. Check with the computer specialist press or the suppliers themselves for the up-to-date situation on prices and availability.

Zarm

Title: Planetoid
Micro: BBC Model B
From: Acornsoft Ltd
c/o Vector Marketing Ltd
Denington Industrial Estate
Wellingborough
Northants NN8 2RL
Tel: (0223) 316039

Wave after wave of invading aliens are determined to carry off the inhabitants of a planetoid (hence the game's name) to their own domain. You must stop them by manoeuvring your spacecraft around the screen destroying them. Sounds simple? Well, try it. If an alien should capture an inhabitant of the planetoid and carry it upwards, merely destroying the alien is not enough. If you do, the creature is released high above its planet's surface and starts downwards at a rate of knots! You can gain bonus points and bring a smile of relief to the creature's face by catching it and bringing it gently to the ground again.

I enjoyed this game enormously. I quickly found that the various alien craft behave in slightly different ways and demand slightly different treatment. Planetoid is controlled from the computer keyboard. There is no

joystick option. The keys take some getting used to, but the 'all fingers and thumbs' stage soon passes.

As the game progresses successive waves of aliens become more difficult to deal with, but as you gain experience from endless hours of play (yes, it's one of those addictive games cited in divorce proceedings) you can get further and further into the game.

Planetoid features very good graphics, as one might expect from Acornsoft, the software arm of Acorn, the BBC Micro's manufacturer. The version reviewed here was loaded into the computer from a 'floppy disk', which is much quicker and more reliable than a tape cassette. Both disk and tape versions are widely available.

Planetoid is a fast action space battle with excellent graphics and full sound effects.

Title: Missile Base
Micro: BBC Model B
From: Acornsoft Ltd
c/o Vector Marketing Ltd
Denington Industrial Estate
Wellingborough
Northants NN8 2RL
Tel: (0223) 316039

You're on the Moon and it's raining neutron bombs! As Moonbase commander, you must protect the base from the showers of approaching bombs. Using either the keyboard or a joystick, you must guide your missile sights to a point ahead of the current position of the bomb. When you fire the missile, it takes a moment to reach the target point and explode. If the neutron bomb has already passed, it carries on undamaged towards your base.

The first wave of bombs is relatively easy to destroy, but later in the game, smart bombs appear on the scene. They can dodge your missiles! Multiple warhead devices fragment into a number of separate targets that must all be destroyed. I found that the 'switch action' joystick that I was using wouldn't work properly with this game. It simply switched the commander's sights to three positions on the screen. It was impossible to place the sights at any intermediate position. However, the game can be played quite easily by using the keyboard.

If you manage to make a respectable score, you can enter it in the high-score table at the end of the game. The action is deceptively slow. A casual observer might think it a rather unexciting game, but the realistic delay between firing your missile and the subsequent explosion at the target introduces an interesting element of time and position evaluation. The game doesn't need to be any faster.

Missile Base is available on both tape and disk. The version reviewed here was supplied on tape.

Title: Cylon Attack
Micro: BBC Model B
From: A & F Software Ltd
830 Hyde Road
Gorton
Manchester M18 7JD
Tel: 061-223 6206

Of all the programs reviewed in this issue, Cylon Attack took the longest time to load (over five minutes), but it was well worth the wait.

You are the one and only interceptor pilot on board an Earth supply craft. The dastardly Cylons are determined to remove you from this universe. As each wave approaches, you are launched into their midst. You must destroy every enemy craft and then dock with your mother-ship to re-fuel before the next wave arrives.

The program offers you two different control key options or alternatively joystick control. The screen shows the view through your laser sights, the long range radar plot and an instrument panel. The instruments show shield strength, fuel level, rate of climb, rate of turn and laser power level.

Using the long range radar, you can steer your craft towards the enemy until they appear in your sights. When you're within laser range, the sights change, indicating that you have a good chance of hitting the target. If they change again, your targeting system has locked onto it. If your fuel reaches a dangerously low level, a warning bell sounds. When you hear it, you must dock with the mother-ship, but the enemy will make a bee-line for you and attack. Each successive wave of attackers contains ever-more difficult types of craft to get rid of without suffering damage.

I liked this game. I kept coming back to it to try to better my score and if I'd had to pay out my hard-earned cash to buy it, I'd feel that I'd got my money's worth.

Title: Moonraider
Micro: BBC Model B
From: Program Power
Micro Power Ltd
8/8a Regent Street
Chapel Allerton
Leeds LS7 4PE
Tel: (0532) 683186
(0532) 696343

Your aim is to raid an alien base established on the Moon. The aliens are waiting for you with six stages of defence between you and their precious command base. Your armaments consist of a laser cannon and a full (and apparently inexhaustible) load of bombs.

Moonraider is equipped with a comprehensive array of controls. You can use the computer keyboard, but you're not limited to the set of control keys given in the program. If you don't like them or find them awkward to use, you can change them to whichever control keys you want to use. In addition, there is a joystick option.

There are six levels of difficulty and four different types of mission. You can either run through them one after another, or skip the easier levels and missions to try more difficult missions first. If the sound starts tingling your nerve endings, the programmer has been considerate enough to let you switch it off.

Your spacecraft flies along a hostile landscape. In one mission, rockets on the ground take off in front of your ship risking collision and space mines float around in your path. In another, you have the additional hazards of meteor showers and cannon on the ground firing up at you. There's lots of action in this game, although the missions and levels of difficulty are mostly variations on the same theme.

Next month: a selection of programs for the Sinclair Spectrum and the BBC Micro's latest offspring – the Acorn Electron.

Title: Martian Attack
Micro: BBC Model B
From: Program Power
Micro Power Ltd
8/8a Regent Street
Chapel Allerton
Leeds LS7 4PE
Tel: (0532) 683186
(0532) 696343

You have been entrusted with the defence of a city on Mars, which is under attack from the dreaded Zargons. The screen represents the restricted view you have down the 'barrel' of your trusty laser cannon. The Zargons are creatures of habit, in that they always approach the city from the left! You can sweep your sights to the left to await their arrival and then blast them out of the sky. If you miss, the Zargon ship will return from the right to try to bomb the city again. Another ship will also be on its way from the left! If you fail to hit the Zargon, you can protect the city by switching on an energy field capable of deflecting the invaders' bombs. This consumes lots of energy. There are three different Zargon ships, each with a different flight pattern.

You can control the game by keyboard or joystick, the latter being by far the easiest method. However, I found that the joystick I was using worked with a switching action rather than a smoothly changing action and was unsuitable for this game. Instead of making the laser sights move smoothly up and down the screen, it only allowed the sights to be switched into three levels – high, middle and low. If the Zargon appeared at an intermediate level, there was no way of shooting it down – most inconvenient for the inhabitants of the Martian city. I quickly tired of this game.

Title: Zarm
Micro: BBC Model B
From: Program Power
Micro Power Ltd
8/8a Regent Street
Chapel Allerton
Leeds LS7 4PE
Tel: (0532) 683186
(0532) 696343

You are the commander of a Zarm craft (why Zarm??) trying to collect a group of survivors (survivors of what, one wonders) from a planet's surface. Simple, n'est-ce pas? Well, you must release your craft from a mother ship that is moving from side to side over a sea of moving asteroids. When you spot a gap in the asteroids, you can release your craft from the mother ship and steer it through the asteroids. You must also use thrust to stop the craft from crashing into the planet's surface.

You can change the game's control keys if you'd prefer to use an alternative set. There are separate sound and music controls, so that you can turn off either the sound effects or the music or both. If you are heading for destruction, you can cheat – sorry, you can employ superior technology, and become invisible. Naturally this uses huge amounts of energy. If you do manage to land, you are awarded bonus points according to how quickly you reached the surface and how much energy you have in reserve. I found this game very difficult to play – probably more to do with lack of co-ordination in the editorial digits than any inherent shortcoming in the game itself.

They were ordinary men and women who shared a common ambition and what they achieved together captured the imagination of the world

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UFO ENC

CHRIS MORGAN BRINGS THE UFO STORY UP TO DATE WITH A LOOK AT MODERN ENCOUNTERS. PAINTINGS BY DAVID HARDY.

The most important date in the history of UFOs is June 24th 1947. It marks the beginning of the modern period of UFO observations. It is also the watershed between the old-fashioned treatment of UFOs as unconnected events and their much more scientific treatment as probably connected cases of the same phenomenon. Only since that date have books been written on the subject of UFOs, have organisations and magazines appeared which are devoted to them, and have the terms 'UFO' and 'flying saucer' become known to the public.

What happened on June 24th 1947 was that an American named Kenneth Arnold saw a formation of nine strange objects flying through the air at a very high speed. This was not the first US UFO sighting of the post-1945 period, nor the first involving saucer-shaped craft, nor was it a particularly close or detailed sighting, and its only witness was Arnold, who had no camera with him. Yet despite all these factors it received a huge amount of publicity and has become celebrated as the beginning of an era.

Kenneth Arnold was a successful businessman, aged 32 in 1947, who owned a company which supplied fire control equipment, based in Boise, Idaho. He held a pilot's licence and was an experienced flier. On the afternoon of June 24th he was flying his own small, single-engined Callair aircraft across the Cascade Mountains from Chehalis to Yakima in Washington State, in the north-western corner of the USA. His nominal flight distance was under 120 miles, but all pilots overflying the area had been asked to look out for signs of a large troop-carrying transport aircraft which had disappeared – believed crashed – in the vicinity of Mount Ranier. That mountain, rising to 14 410 feet, was close to Arnold's due-east route, and he diverted to search for wreckage.

A sudden flash of reflected light made Arnold look round. He saw nine unidentified craft flying towards Mount Ranier from the north. Although they were some twenty or so miles away from him it was a clear day and he was able to get a good view of them. One was crescent-shaped with what appeared to be a central dome, while the other eight – flying behind in a diagonal formation, like a skein of geese – were flat and shaped like pie dishes.

Right: Looking towards Mount Rainier across the Cascade Mountains, Kenneth Arnold sights a flash of light reflected from a chain of 'flying saucers' – and sparks off a chain of sightings which continues to this day. Below: Only sheep witness this UFO as it is struck by a lightning bolt during a summer thunderstorm. Next day, rancher Brazel, arriving to check his fences, will find wreckage scattered over a wide area.

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UFO ENCO

None had tails like conventional aircraft. They were very shiny, and they moved in rather a peculiar jumping manner, 'like a saucer would if you skipped it across water', to use Arnold's own description. They were flying at roughly the same height as Arnold's aircraft, 10 000 feet, but were keeping close to the mountain peaks, swerving in and out between them. The most surprising thing about these craft, though, was their high speed. Arnold timed them between Mount Ranier and Mount Adams (to the south-east), and based on this their speed was later calculated at over 1600 mph.

It is tempting to suggest that Arnold was mistaken or made it all up. After all, he was on his own, the objects were a long way from him, and doubts have been expressed as to whether the human eye can follow objects travelling at such a high speed. Yet Arnold was a man of honesty and good repute. He could not have expected to gain anything by fabricating such a story. (In fact he *did* gain financially, but he was the first UFO observer to do so and no such gain could have been predicted.) Also, he was used to flying across the mountains of Washington State and knew his route well.

Arnold described his experiences to newspaper reporters, and the story became headline news across the USA. The flying objects were quickly dubbed 'flying saucers' from their peculiar motion through the air (rather than from their shape) and they captured the public imagination immediately. Because of their odd shape and high speed (two and a half times greater than any man-made aircraft of that time) the flying saucers were at once assumed to be extraterrestrial in origin. The enormous publicity surrounding the Arnold case brought revelations of similar sightings elsewhere in the USA over the previous month or two, while new reports came in growing numbers, almost daily.

Saucers on the brain

Although there was much public disbelief and ridicule there was also a sense of excitement. Undoubtedly many people wanted to see flying saucers, often so badly that they seized on any slightly unusual aerial phenomenon and called it a flying saucer. Others allowed their imaginations to supply the phenomena, while some perpetrated deliberate hoaxes, and it became very difficult to ascertain the validity of trustworthiness of any particular report. A new wave of sightings had been sparked off by the initial reaction to the Arnold case. During 1947 there were 853 reported sightings (*Report on the UFO Wave of 1947* by Ted Bloecher, 1967), of which some occurred before, but none were reported to the press until after, June 24th. Many of the witnesses claimed to have seen flying saucers identical with those observed by Arnold.

Continued sightings

The most unusual thing about this 1947 wave of saucer sightings is that it is still continuing: it did not fade out after a few months like all previous waves but is still with us to this day, gaining a few hundred new sightings each year.

But what of Kenneth Arnold? He was embarrassed by the notoriety which surrounded him, yet he stuck to his facts resolutely, neither altering nor embellishing, and was unwilling to offer any explanation of his sighting. In 1950 he published privately a small pamphlet about his experience near Mount Ranier, and in 1952 he collaborated with Ray Palmer (editor of *Fate* and *Flying Saucers* magazines, an early enthusiast of UFOs) to produce a book on the subject, *The Coming of the Saucers*. Interestingly, Arnold has claimed to have seen several other UFOs since 1947, and in 1962 (in an issue of *Flying Saucers* magazine) he asserted that flying saucers are neither flying vehicles nor extraterrestrial in origin but 'are groups and masses of living organisms that are as much a part of our atmosphere and space as the life we find in the depths of our oceans. . . they have the natural ability to change their densities at will.'

It is worth looking at some of the other 1947 UFO sightings. For example, on June 21st, three days before Arnold's eventful flight, a group of doughnut-shaped UFOs was seen just off the coast of Washington State. Four people in a boat made the sighting, of whom one, Harold Dahl, took photos of the UFOs. Apparently one of these craft dropped some pieces of metal overboard before flying off. The USAF investigated this and, although a statement was made by them to the effect that it had been a hoax, this case has some unexplained aspects. Elsewhere in the USA quite a few responsible people, whose evidence could not be ignored, were also seeing strange things in the sky. Three policemen in Portland, Oregon, saw flying discs. A USAF pilot saw a formation of five or six aerial discs as he was flying over Nevada (this was on 28th June). Other Air Force and civilian pilots had similar experiences. Strangely, there was a UFO wave in Hungary that same month, with about fifty reports of silvery balls seen in the sky by daylight.

Such big news did flying saucers become that sightings could not be ignored by the US government. Towards the end of 1947 steps were taken to set up an official US Air Force department which would investigate and try to identify every UFO report. This was inaugurated in January 1948 as Project Sign.

Planes give chase

That same month a very dramatic UFO case occurred in the state of Kentucky. Many witnesses on the ground, including officers at Godman Air Force Base, saw a very large object in the sky. (The time was early afternoon.) Descriptions varied considerably – it may have been conical, globular or disc-shaped, and silver, white or red-and-white in colour. Three P-51 Mustang fighter aircraft gave chase. These were single-seaters, carrying no oxygen equipment. The senior pilot, Captain Thomas Mansell, disregarded safety regulations and climbed to 20 000 feet in pursuit. The other two Mustangs turned back at 15 000 feet. Shortly afterwards radio contact with Mansell was lost. The wreckage of his aircraft was found later, a few miles away.

Those are the facts, but much speculation surrounds the case. The official version is that Mansell was chasing a Skyhook weather balloon (which was then still on the classified list) and that he blacked out through lack of oxygen. Yet Mansell was a very experienced pilot, and the official explanation satisfied neither the public nor the media. It must go down in the records as 'not proven' and as the first instance of a UFO leading a man to his death. It was almost as spectacular and controversial an incident as the Kenneth Arnold case, and it helped to increase public awareness to the existence of UFOs.

Within nine months of its foundation the personnel of Project Sign had prepared a report concluding that UFOs were, possibly, visiting extraterrestrial spacecraft. This report was not accepted by the Air Force Chief of Staff, and the investigation was reconstituted on different lines in February 1949 as Project Grudge, which seemed to have been given the task of debunking any suggestion of extraterrestrial involvement. Later on (1952) Grudge became the better known Project Blue Book.

From March 1949 the US Central Intelligence Agency (CIA), too, has interested itself in UFO sightings. Without doubt this

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measure was taken because UFOs were considered to be a possible or potential threat to the security of the USA. The fact that the USAF and the CIA continue to investigate UFO reports shows that the threat still exists.

The Roswell Saucer

All post-1945 UFO sightings in the USA have been investigated by one or more US government agencies. Even before specifically named projects or officers were set up for this purpose, both the US Air Force and the Central Intelligence Agency looked into UFO cases to see if there was any extraterrestrial involvement. Where the reports of these agencies have been made public (as in the cases of the US Air Force's Project Sign, Project Grudge and Project Blue Book) all UFO sightings have been explained away as natural phenomena, ordinary aircraft, mistakes or hoaxes, or (in a small percentage of cases) they have been listed as 'unidentified'. In other words, no US government agency has ever admitted officially that any specific UFO was an extraterrestrial spacecraft.

Does this mean that none of the thousands of UFOs seen over the USA since mid-1947 have been extraterrestrial spacecraft? No, all it means is that the US authorities have been unwilling to admit to their existence. In fact there is a considerable weight of evidence which suggests that the US authorities not only know of the existence of extraterrestrial spacecraft, but that at least one such craft has been found, complete with its non-human occupants, and kept hidden behind a tight security screen for over 35 years.

Early in 1950 stories appeared in some US newspapers to the effect that the US Air Force had possession of the wreckage of a flying saucer and the bodies of its tiny crew members. Later that year a more detailed version of the story appeared in the book *Behind the Flying Saucers* by Frank Scully, a US journalist. This claimed that three flying saucers had been found crashed in Arizona or New Mexico, together with the bodies of 34 alien crew members, sometime during the later 1940s. The US Air Force was said to have removed all physical evidence to a secret location, threatening civilian and service witnesses with dire consequences if they divulged any details. Despite this alleged conspiracy of silence, Scully's book contains a description of the aliens. They were supposed to be small humanoids about a metre tall and to have come from Venus. Their saucers contained many mechanisms and materials which could not be identified by the Air Force scientists, though it was believed that the aliens drank heavy water and ate small wafers which swelled up in water.

Air Force deinals

Behind the Flying Saucers caused a great furore, even though it was categorically denied by the US Air Force. About two years after the book's publication it was condemned as a hoax and Scully was discredited. It seems to have been true that two of Scully's major informants were confidence tricksters and that some of the details in the book were exaggerated or entirely made up. Even so, the central idea of a saucer crash in south-western USA with all details hushed up by the authorities almost certainly has some factual basis. In the first place, there have been many independent rumours of this event, provided by retired Air Force personnel of their families. Secondly, it is alleged that Captain Edward Ruppelt, soon after he retired as chief of the USAF's Project Blue Book in 1953, met Frank Scully and told him that *Behind the Flying Saucers* had caused problems for Project Blue Book because it was close to the truth. Thirdly, a new investigation into the subject in 1979 by Charles Berlitz and William Moore produced a great deal of new evidence for the existence of a conspiracy and made clear the probable outline of events, though without, it must be admitted, obtaining any direct physical evidence. Their book is *The Roswell Incident*, 1980.

On the evening of July 2nd 1947 a flying saucer was seen to travel over the small town of Roswell, New Mexico. Near the town it passed through a thunderstorm and was struck by lightning, suffering severe damage and losing a lot of material. (Although there were no human witnesses of the lightning strike, David Hardy's picture captures the event.) This debris fell to earth on the Brazel sheep ranch, about half-way between Roswell and Corona, and it was found by the ranch's owner next morning. It was all in fragments, some pieces of sheet and some pieces of strut or beam, but all of it very light in weight and extremely strong. Despite having the appearance of tinfoil, these pieces could not be bent or dented, even with a heavy hammer. It was a material unknown on our planet.

Personnel from the Roswell Army Air Base collected it all up and took it away. Several days later, on July 8th, the base's public information officer put out a statement that a 'flying disc' had been found and taken to the base. But higher levels of command quickly denied this. The debris was flown to Fort Worth in Texas, where it was declared (at a press conference) to be just a weather balloon. All relevant witnesses contacted by Berlitz and Moore agreed that this was a cover-up story.

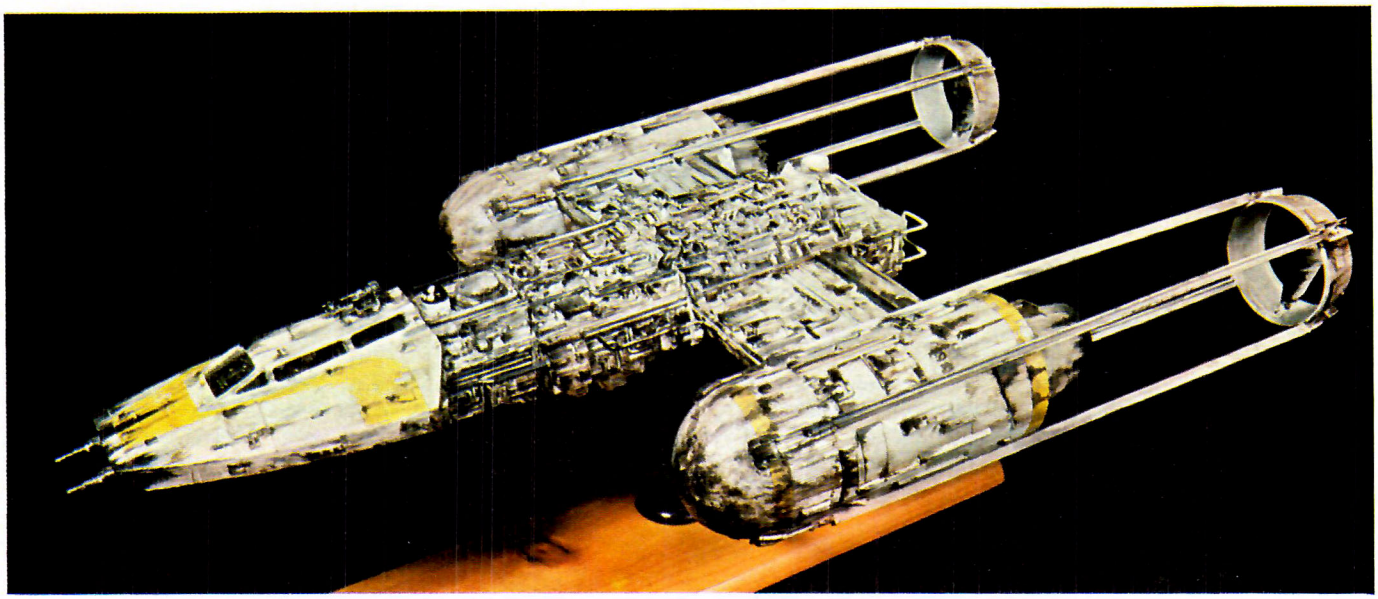
The damaged flying saucer had struggled on for about 125 miles after the lightning strike before crashing on the deserted plains of San Agustin, not far from the town of Socorro, New Mexico. This wreckage, easily identifiable as a large metallic disc about nine or ten metres in diameter and with non-human bodies (all dead) visible inside and nearby, was found the next morning, July 3rd. One witness was a civil engineer who lived locally; others were members of an archaeological expedition from the University of Pennsylvania. They barely had time to look at the wreckage before Air Force officers arrived, telling them to leave at once and say nothing.

Autopsies on ETs

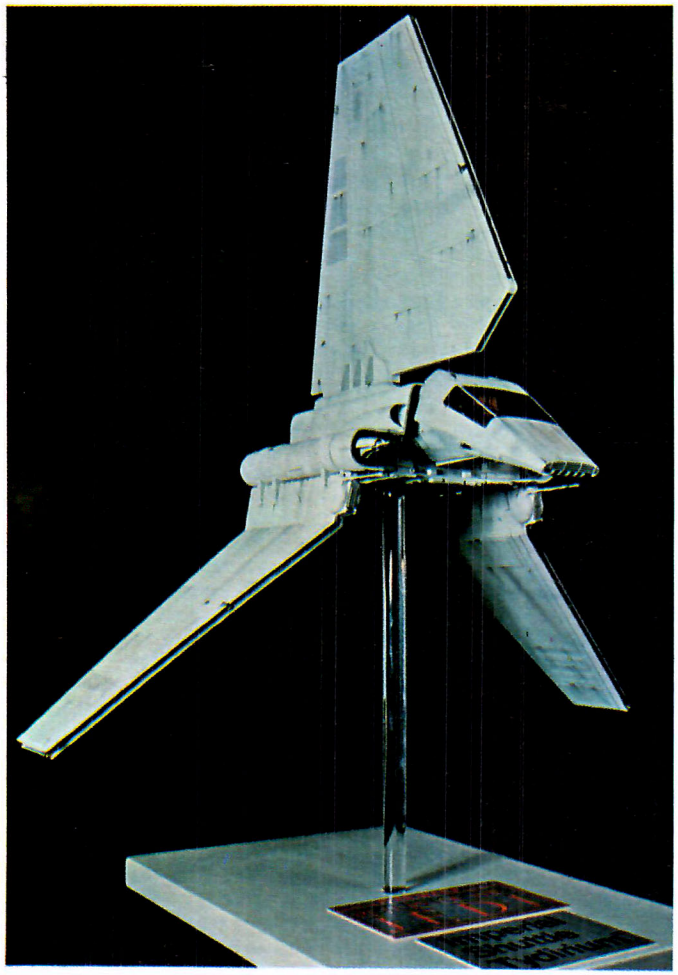
The saucer and its alien occupants (about 30 of them) were transported by truck the several hundred miles to Edwards Air Force Base in California, which was the nearest secure site with adequate facilities for scientific investigation of the saucer and the performance of autopsies on the crew. By putting together details supplied by several informants, Berlitz and Moore managed to conclude that the aliens were approximately one metre in height, humanoid though with a larger head in proportion to body size than we have, having no external ears or nose, no hair on their heads or bodies, extremely thin limbs, hands with four fingers but no thumbs, and greyish skin.

At various times during the late 1940s and early 1950s it was expected by Air Force officers privy to the secret that the existence of the saucer and aliens was about to be made public. It is suggested that President Eisenhower secretly visited Edwards Air Force Base in February 1954 to view the remains.

Assuming that all the verbal evidence is reliable, the conclusions to be drawn from this are that Scully's book was at least partly true (his 'three saucers crashed in Arizona or New Mexico' could refer to the debris and crash sites in New Mexico and to the fact that the saucer was transported across Arizona by truck en route to Edwards Air Force Base) and that the whole affair is still subject to an official conspiracy of silence by the US authorities.



SPACE MODELLING
AT THE MODEL ENGINEER EXHIBITION



A PICTORIAL TOUR AROUND THE SPACE SECTION AT THIS YEARS SHOW.

Space and science fiction, fact and fantasy models abounded at this year's Model Engineer Exhibition held at Wembley back in January. The show proved to be the best yet for entries in the space modelling competitions, and the camera of model photographer John Wylie captured these outstanding studies – we'll be publishing more in future issues.

At right, "Leopard Girl" was the title of this powerful vignette by M. C. Taylor of Birchington; it won a Silver medal. Below, A. Cook's superbly scratchbuilt "Y-Wing Fighter" also acquired one of the M. E. Exhibition's coveted Silver medals.

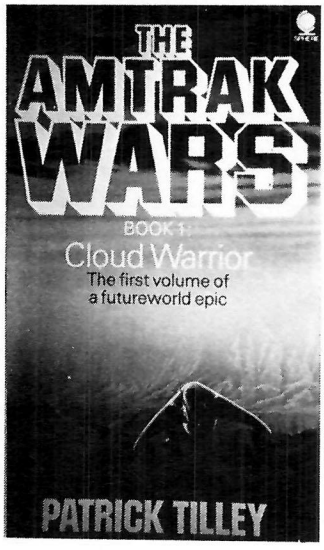
On opposite page, top left, "Imperial Tyridium Shuttle" by A. D. North of Burnham. Top right, this sexy study by S. Harry of Rickmansworth is titled "The Huntress"; it gained a well-deserved Bronze medal. Bottom, Highly Commended in its class at Wembley was this "Speeder Bike" from Return of the Jedi *by J. Neeves and A. Szarama. More winning pics to come soon. . .so watch this space! Photos: John Wylie*

READ OUT

SCIENCE FICTION

'Little, Big' by John Crowley. Published by Methuen at £1.95. Soft covers.

This is the story of a house, Edgewood, and its inhabitants. It covers over five hundred pages of small print for nearly two pounds, so it's a real bargain, if you like fantasy. It would take almost as many words to tell you what the book is about. If you can, imagine a cross between Peake's 'Gormenghast' but more cheerful, and Tolkien's 'Smith of Wotton Major', but vaguer. But if you like fantasy, do try this. It may not be your cup of tea, but it would be a tragedy if it is and you missed it. So far I've read it through twice, following the adventures of Daily Alice and Violet Bramble, Alexander Mouse and Smoky Barnable, and it is like slipping into a strange, seemingly random world, where rules exist, but one cannot quite grasp them. I think I like it, but it is so big that I may need a couple of years to be certain. **MV**



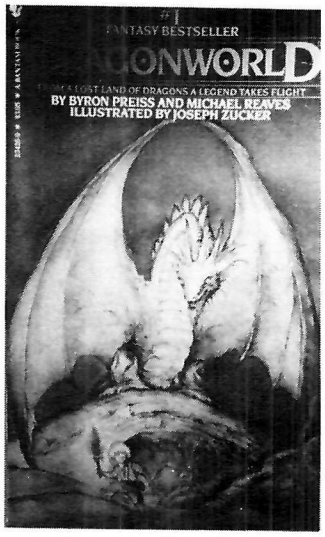
'The Amtrak Wars' by Patrick Tilley. Published by Sphere at £1.95. Soft covers.

This is the first volume of a futureworld epic, according to the cover. I must admit that I groaned slightly at this, and groaned more sincerely when I read the blurb on the back and discovered that it takes place a thousand years after yet another atomic holocaust. But Patrick Tilley tends to write offbeat books, so I persevered. The Amtrak Federation has been deep in underground shelters, and is now planning to expand by means of huge trains running through the hinterland. The survivors of those left outside in the radiation – the Mutes – are physically and mentally altered by their heritage, but some appear to be not only unchanged but superior in memory and in the handling of psychic talents. We meet a part of the Plainfolk, as they call themselves, with their prophet and miracle worker, Mr Snow, and learn of the Talisman prophecy. Two children of the tribe, Cadillac and Clearwater, each of whom has inherited a straight body and certain gifts, are told that the day of the prophecy is at hand.

In the Federation, Steve Brickman, a newly-trained pilot, is sent out with one of the trains as they start their plan of over-running the plains and killing and enslaving the Plainfolk. Steve crashes, and is saved by Cadillac, who somehow knows him. An interesting first volume, if the rest can keep the pace going at this level it will indeed be an epic. **MV**

'The Book of Lost Tales, Part 1' by J R R Tolkien. Published by Allen & Unwin at £12.50. Hard covers.

Last week an assistant in one of the High Street bookshops belonging to a well-known chain was overhead telling a customer that of course there wasn't a new Tolkien book out this Christmas, as Tolkien had been dead for years! At the rate that his writings are coming out it seems unlikely that they will all be in print before his copyright expires in 2023. Anway, this is the first part of his writings which were begun in 1916-17. Edited by Christopher Tolkien it includes Notes and Commentary, an Appendix, Glossary and Index. It is for the 'serious' enthusiast, rather than the Hobbit-lover. If you liked the Silmarillion you will love this. If you thought it stuffy and boring, then leave this alone. My only complaint is that there are no illustrations, but you could always buy the Tolkien calendar. **MV**



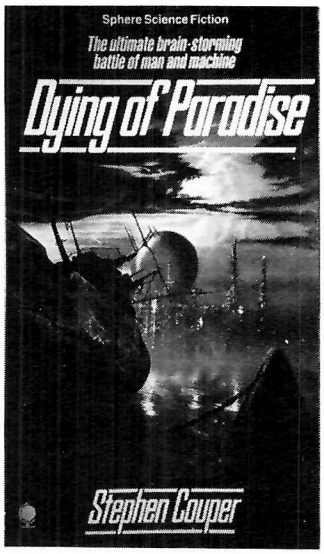
'Dragonworld' by Byron Preiss and Michael Reaves. Published by Corgi at £2.50. Soft covers.

At last we have a normal size paperback of this. For years it has been out in trade size, always too big for one's bookshelves, and although the illustrations by Joseph Zucker are quite good, they have not been spoilt by reduction. This is a story of two cultures – Fandora, rural, quiet, a little old-fashioned, and Simbala, sophisticated, more technological, yet afflicted with tangled politics. Children are mysteriously killed in Fandora, and surely Simbala must be to blame. Only war can stop other children being killed. One man, the hermit Amsel, disagrees. A Simbalese child has also been murdered, yet Hawkwind, the leader of the Simbalese windships thinks not of human enemies but of the old legends of dragons. The truth is unbelievable to both sides. **MV**

'Dying of Paradise' by Stephen Couper. Published by Sphere at £1.75. Soft covers.

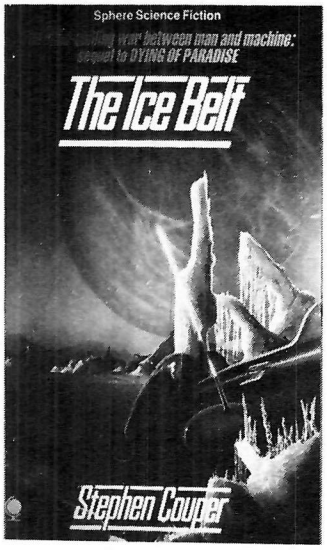
'The Ice Belt' by Stephen Couper. Published by Sphere at £1.95. Soft covers.

Stephen Couper, better known as Stephen Gallagher, has produced a pair of good, exciting books, with



a lot behind the superficial adventures.

Persephone was once a rich planet while its harvest of a valuable narcotic drug lasted, but that was long ago. Now it is divided into two classes – the citizens, genetically controlled and ruled by the Central Command Computer and its Elite Police, and the deprived slaves of the underbelly. No

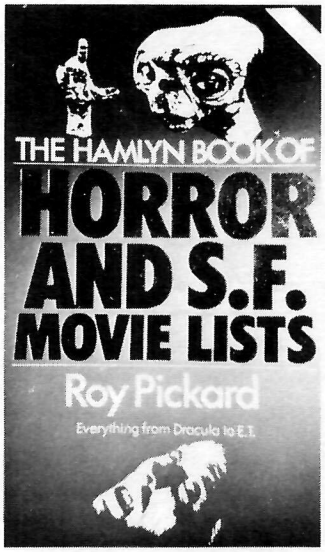


one is really happy, but it is only when one of the citizens accidentally finds a forgotten history of the early days of the abandonment of Persephone that there seems any chance of breaking the stranglehold of Central Command

'The Ice Belt' is a sequel, staged

in 'Ice Palace' and unless you read the first book first you will be lost. Yet this isn't a re-run. It reveals a deadlier peril to Persephone than the computer. Both are worth reading, and I hope that there will be more to follow. **MV**

GENERAL



'The Hamlyn Book of Horror and SF Movie lists' by Roy Pickard. Published by Hamlyn at £1.95. Soft covers.

Did you know that Peter Cushing has played Professor van Helsing in five films, against Edward Van Sloan's twice? It doesn't only cover horror films, there are 11 pages on Star Trek alone, and two pages on Christopher Lee, who titled his autobiography 'Tall, Dark and Gruesome', plus items on George Pal, Robert Wise and Vincent Price. It isn't perfect. For example, it omits 'Santa Claus Conquers the Martians' from the list of Turkeys, but if you didn't know before that Bela Lugosi was buried in his Dracula cape, that Karloff's make-up as Frankenstein's monster took four hours each *day* to apply, and you care, buy this book. **MV**

SCIENCE FACT

'The Atlas of the Solar System' by Patrick Moore and Garry Hunt. Published by Mitchell Beazley in Association with the Royal Astronomical Society at £19.95. Hard covers.

This is a larger, thick book which most of us cannot afford, so why not ask your local library to get it? It has both colour and black and white pictures, many photographs and facts about each member of the Solar System, including lists of Moon Craters, and the various Space Missions, comets and meteors. It is both authoritative and up to date, so console yourself for the lack of new missions by reading about how much has been discovered in the last few years. There are beautiful colour photographs of Mimas and Saturn, taken by Voyager. In fact, Saturn looks just like any painting I have ever seen. This book seems likely to stay up-to-date for some time, so maybe it is affordable. If there is nothing new in the next ten years, which seems likely, at £2.00 a year this is worth every penny. **MV**

'Patrick Moore's History of Astronomy' by Patrick Moore. Published by Macdonald at £14.95. Hard covers.

This historical overview of astronomy is, in fact, a revised and extended sixth edition of 'The Story of Astronomy', which itself was first published in 1961 by the **Oldbourne Book Company** as 'Astronomy'. It's a highly illustrated book, in which the irrepressible Patrick Moore tells the story of astronomy from the remote past right up to March 1983.

In the foreword, the author modestly writes, 'Inevitably, much has been left out and much more has been glossed over; but I hope that what I have written may be of interest to those who read it.' If you've ever watched 'The Sky at Night', you will be familiar with the readily understandable and above all enthusiastic way in which the author presents factual material. Does the man never tire of his subject? Apparently not.

This meaty volume treats the story of astronomy chronologically up to the beginning of the twentieth century. Thereafter, as the author explains, there have been so many advances in so many overlapping areas of research that it is impossible to continue the sequential order of events. Instead, the author looks at how the various techniques of astronomical research (photography, radio, space probes, spectroscopy, etc) have played their part in furthering our knowledge of the universe.

It isn't simply a dry list of dates and events. In revealing how the epic adventure of astronomy has unfolded, the author explains each concept or technique in everyday English. It's an ideal introduction to astronomy and also a very useful reference work to come back to again and again. Thoroughly recommended. **IG**

'An Illustrated Guide to Spy Planes and Electronic Warfare' by Bill Gunston. Published by Slamander at £3.95. Hard covers.

I spotted this book in a tiny model shop in Aldershot, while looking for something entirely different. The cover illustration of the high-flying Lockheed SR-71 'Blackbird' spy plane caught my eye. Aircraft manufacturers and the air forces who fly their planes are naturally reluctant to reveal more than the existence of their spy planes, and sometimes not even that! I take my editorial hat off to Bill Gunston, therefore, for bringing together a wealth of interesting facts and figures about some of the world's most secret aircraft.

This beautifully illustrated (mostly in colour) 160-page book reveals details of over 80 aircraft and RPVs (Remotely Piloted Vehicles) together with an insight into the world of electronic warfare and reconnaissance systems. It should provide an interesting read for those of you who may not be aircraft buffs, but are nevertheless curious about the more exotic flying machines around today. **IG**

REVIEWERS
MV – Marion van der Voort
IG – Ian Graham

CONTRIBUTOR'S GUIDELINES

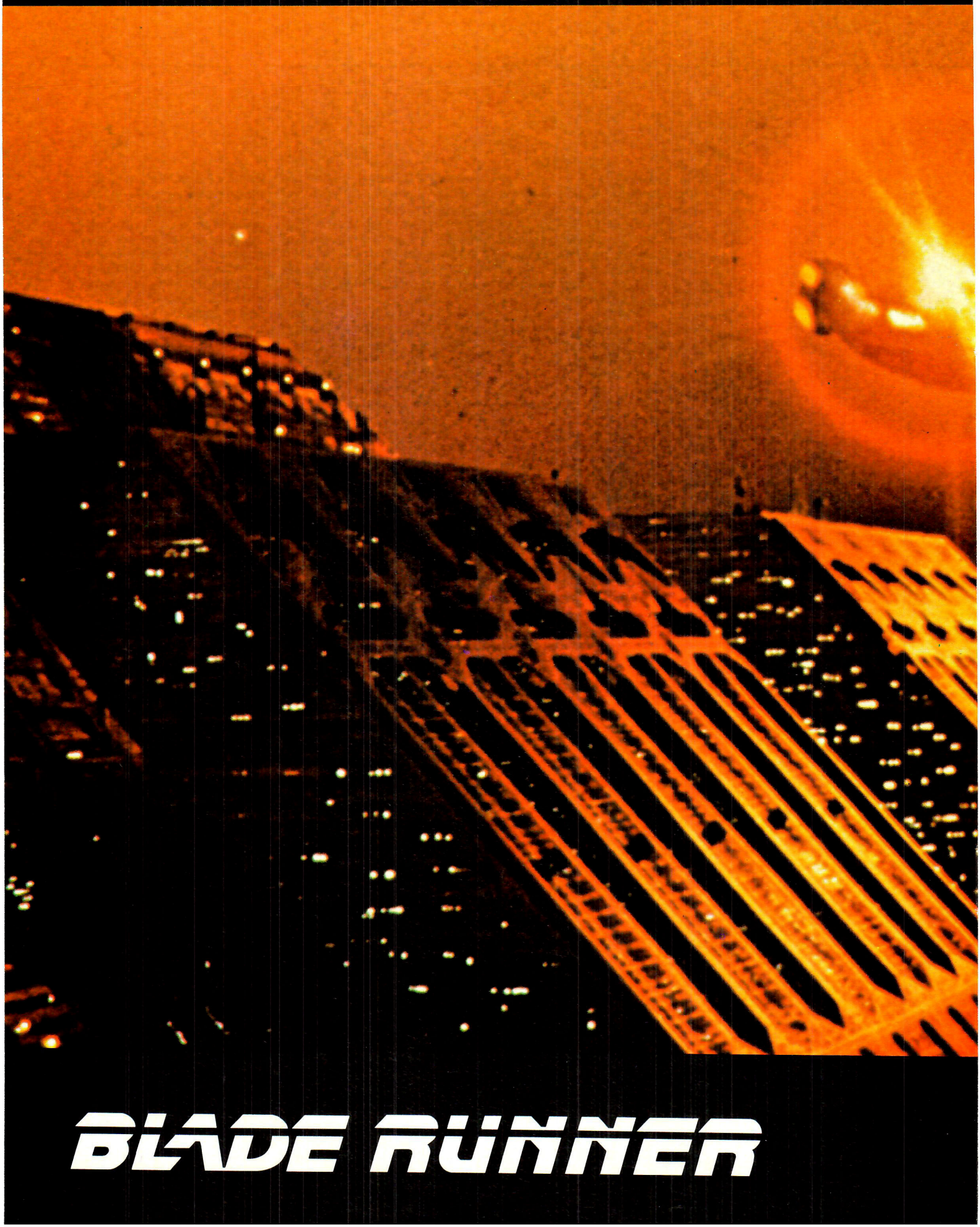
or

How to get into print in five easy lessons

The Space Voyager office in the bowels of M.A.P. regularly receives articles sent in by readers for publication. If you want to send something in for consideration, you can increase your chances of success by following these simple rules:

1. Your article must be typed, double-spaced, on one side only of A4 paper, with wide margins (an inch on either side).
2. You should send all the illustrations necessary (the more the merrier) with the article. Drawings need not be works of art – the Voyager drawing office will probably redraw them anyway. Photographic images can be either prints or transparencies, colour or black and white.
3. You must be the copyright owner of all the material submitted or have obtained whatever clearances are necessary for publication.
4. If a reproduction fee is payable or permission is required for the publication of photos or drawings, this must have been complied with before the article is submitted.
5. Articles that have not been specifically commissioned for publication in Space Voyager by the editor must be accompanied by a stamped, self-addressed envelope.

Whilst M.A.P. and Space Voyager take great care when handling readers' submissions, we cannot be held responsible for any loss or damage to unsolicited material (so keep a copy!).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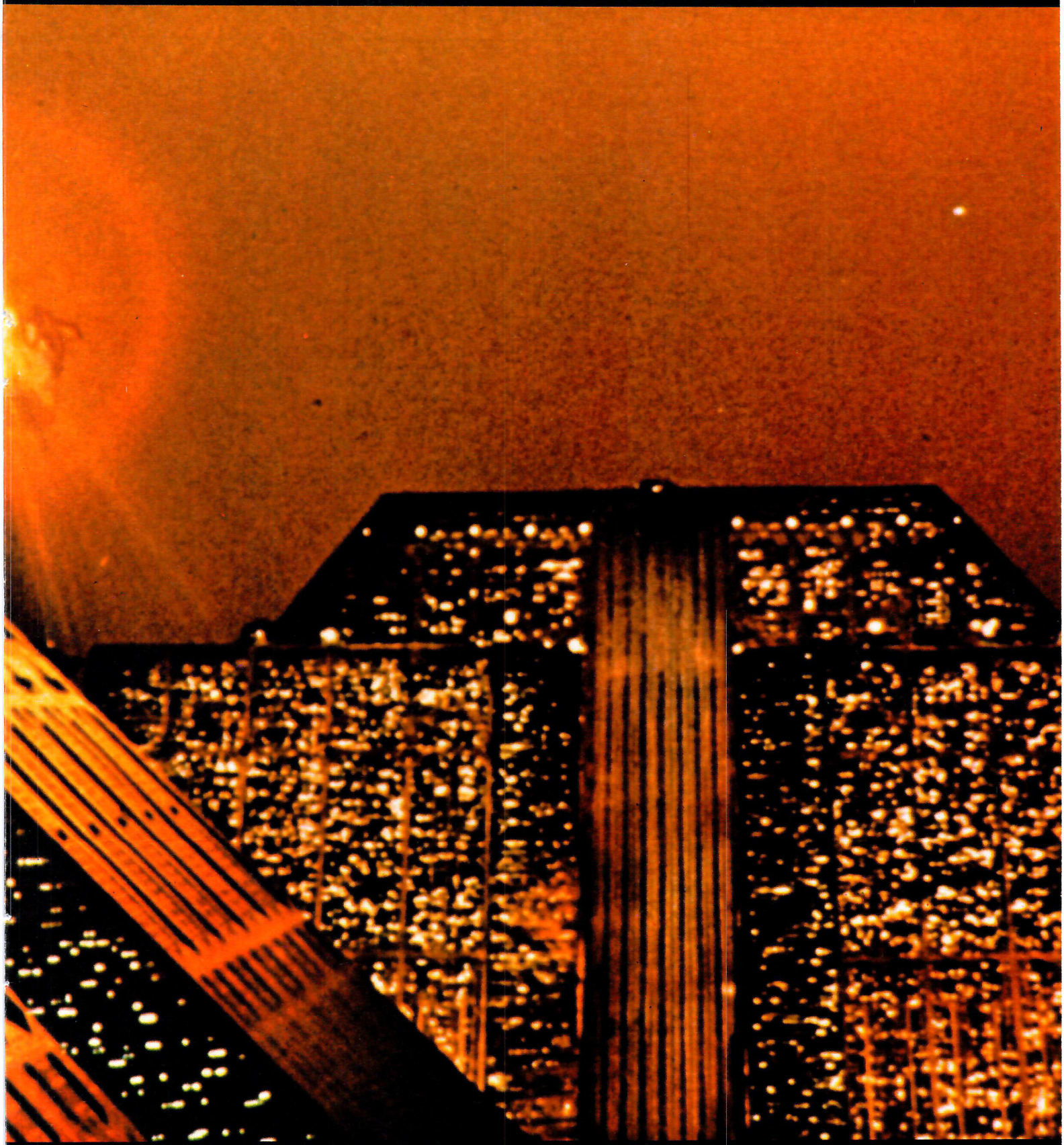


SPACE VOYAGER

COMMUNICATIONS BANK

Sky-jock's who's who

I would like to say how much I enjoy reading Voyager, especially as I am interested in the American space program. I am writing to ask if sometime in the future when 'Shuttle Update' is printed, would it be possible for some photographs of the astronauts to be included in the articles?

In Voyager No 6 reader C Luckett of Oxford in his letter wrote of Super 8 trailers from sci-fi films which are obtainable, but no address was given. Could you possibly forward the said address to me as I would like further information.

Wednesbury *William Gallier*
W Midlands

Ed: *An astronauts 'hall of fame' photo feature is under consideration for a future issue of Voyager.*

More please

I am writing to say that issue No 7 was the best so far. The articles about UFO's were excellent, greatly helped by David Hardy's paintings. Couldn't you do a centrespread of one of his paintings and an article about him, then ones about Chris Foss, Peter Jones, Tim White, etc, etc.

The modelling articles were good, but couldn't you do interviews with model makers such as Martin Bower and Brian Johnson on how they make the actual models for filming, like the refinery from *Alien* (my favourite film) or the Star Destroyers.

Marion van der Voort's unsung master Philip High was a great insight on a surprisingly unknown writer. Couldn't she now write about Edmund Cooper, whose books get good critical acclaim, but is not widely read. His books include *Cloud Walker*, the most realistic book I have read in any genre, *Kronk*, the upholder of the permissive society, and *All Fools Day*, which is a psycopaths delight.

The only thing I can find wrong with your magazine is that there is not enough of it.

Birmingham *Nigel Savage*

Ed: *You may have noticed that issue No 7 did not have an editor credit on the contents page. After Ray and Mat beamed off the good ship Voyager, I was unable to take the helm immediately because of prior commitments. In the meantime Admiral Gee supervised operations. When he was otherwise engaged with the important things that admirals have to do, ensign Archibald took able control, nudging the throttle into warp drive to produce the cracking issue that you enjoyed so much.*

There's one simple way of getting a bigger Voyager. Printing a larger magazine costs more; so sales and advertising have to generate more revenue. Well, it's obvious, isn't it. If you and all your friends each buy a dozen copies instead of one, we can afford to print more pages!

Star discs

With reference to Glenys Whitcher's letter in the Feb/March issue of Space Voyager, you may be interested to know that the story of all three Star Wars films are available on LP from WEA records on the Buena Vista record label.

Each LP features the music and dialogue from the original soundtrack of the film and includes a 16-page souvenir photo book. The record numbers are:

62101 – The Story of Star Wars
62102 – The Story of The Empire Strikes Back
62103 – The Story of Return of the Jedi

Price – £3.99 *each*. Also, if it's any consolation to Partrisha Ellison I remember *'Torchy the Battery Boy'* and would put its date about 1960.

Finally, congratulations on producing a super magazine. I particularly like reading the modelling features and would like to see more articles on space modelling. How about a series on sci-fi artists? Frank Frazzetta, Roger Dean, Brian Froud and Chris Foss would do for starters!

Stubbington *Steve Wood*
Hants

Torchy's sighting confirmed

May I pacify Patrisha Ellison of Worsley, who asks whether *Torchy The Battery Boy* ever existed. My own memories of the puppet series are rather vague, but I recall seeing it in a long-running children's show on the now-defunct TWW (now HTV West) channel. The series, *Tinker & Taylor*, also screened *Twizzle, Sara & Hoppity* and *Four Feather Falls*. I may be wrong, but I suspect that *Torchy, Twizzle* and *Four Feather Falls* were all produced by Gerry Anderson in the early 1960s, just before *Stingray*. All a long way from *Space: 1999*, eh?

Speaking of Gerry Anderson, most of the science fiction/fantasy magazines seem to be ignoring his new series, *Terrahawks* (not VOYAGER, see Next Issue, ed), which is apparently becoming something of a cult. Personally, though, I fail to see why – because frankly I find it rather disappointing on quite a few levels.

The physical effects are really weak – whatever happened to those spectacular fireballs and palls of smoke that filled the screen during *Thunderbirds, Joe 90* and *Captain Scarlet*? The scripts are weak too, and I notice that the writers use some pretty jokey pseudonyms. Many of the better Anderson series used writers who weren't afraid to use their real names – Alan Patillo, Dennis Spooner, Shane Rimmer. Another gripe is the video game obsession which seems to be the series' running gag. Since this is all happening in the distant future, wouldn't the video game stuff be pretty old hat by then?

Even the voices aren't up to scratch. *'Tiger' Ninestein's* fake American accent is awful, with rolling 'r's where they shouldn't be. The characters themselves are perhaps the most disappointing aspect of the whole thing – it's back to enormous heads perched on tiny, stunted bodies. The faces are beautifully modelled, but compared with *Joe 90* or *Captain Scarlet*, they lack something.

There are other irritations – Windsor Davies' sergeant major party piece, the derivative nature of 'Hudson' (a cross between Lady Penelope's Rolls Royce and Knight Rider's talking car), the jokes surrounding Lt. Hiro's Japanese accent (funny how no-one cries racist when jokes are made at the expense of Orientals. If Kate Kestrel had thick lips and shouted 'Lawdy, lawdy', things would be very different).

For me, the show's redeeming features are the title sequence, the graphics and the music by Richard Harvey. Terrahawks does have a lot going for it, but it could be much better. And while young viewers like the series a lot, it's wise to remember that kids aren't exactly renowned for their discretion or good taste. My nephew once told me that he'd rather watch *Battlestar Galactica* than sit through an episode of *The Twilight Zone*. With that sort of bad taste poisoning the minds of the young, what hope is there for the rest of us. Answers on a postcard, please... (to Mr Williams, not us please, ed).

Mayhill *Graham Williams*
Swansea

Ed: Torchy *even seems to ring a bell somewhere in the dark recesses of the editorial brain... or did my grandfather tell me about it?*

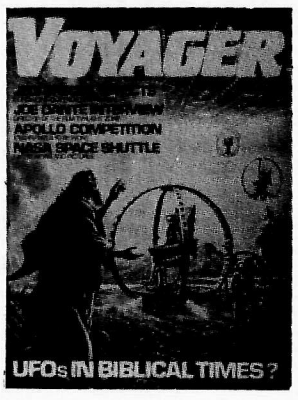
Re Terrahawks, *I expect you feel a lot better getting that off your chest. I've passed your address on to Gerry Anderson, so that he can send the heavy mob round. And that's a perilous last paragraph. Slagging off the younger members of the community and especially calling them 'kids' is rather like putting the wind up the mafia – nephews have friends in low places, you know – I should invest in a pair of shin pads!*

UFOs – naive?

I found the article titled *UFO Encounters* in issue No 6 rather interesting. I feel that the authors have not read the Bible or studied any other related theological texts with any understanding, because the article was rather naive. It makes too many assumptions. For instance, it assumes that flying saucers actually exist. In fact, a lot of so-called UFO encounters within the last 40 or so years were either hoaxes or wrongly identified airborne objects.

The whole account has let pure imagination and fiction run away with it. The speculation in the text has a typical science fiction feel to it. I feel the authors have filled in with too many science fiction concepts to get their points across.

The Bible does not describe flying saucers and heat rays, etc. Incidentally, a beam from a laser cannon would be invisible, because it works in the infra-red



PUBLISHERS' NOTE: The editor reserves the right to shorten letters for publication; opinions expressed by readers are not necessarily those of either the editor or publisher. .

part of the spectrum. Even with our modern technology and understanding, we are not capable of sufficiently understanding the phenomena discussed in the article.

Thus, we are no closer to the truth than those Biblical people. The Bible itself has foot notes at the beginning and the bottom of pages of its chapters and in order to understand the text it is necessary to read these. Ezekeil's wheels, for instance, were types of gyroscopes and the entities, whatever they were, did not look like typical astronauts according to Mr Hardy's painting.

There is one very absurd sentence. To quote, 'If one is willing to believe that any of these strange events in the Bible represents visits to our planet by alien creatures, then one is accepting the theory that God is an astronaut.' Firstly, that is not the implication. Why should it be? One could possibly accept alien visitations but that does not mean to say that God is an astronaut.

From a monotheist stand-point, God is not a biological entity or any other organism. That is, God is not flesh. These experiences documented in the Bible are known as visions. Alkaloids present in many plants can distort perceptions or colours, sounds, etc. Maybe the prophets were suffering from alkaloid poisoning. On the other hand, these visions could be products of a vivid imagination.

So, if the visions were real physical or metaphysical occurrences as their detail and accuracy suggests, they were not descriptions of spaceships or entities like those in Star Wars or Apollo Lunar landings.

I could go on, but I merely seek to refute these flimsey arguments on an important subject and I hope what I have written puts a few things into perspective.

Northampton *Robert Lewis*
East Midlands

Adamski facts

With reference to Sophie Watson's letter concerning George Adamski in Space Voyager No 6, I'd like to supply some information. The book *'Dreadful Sanctuary'* by Eric Frank Russell was first published in *'Astounding Science Fiction'* in 1948, and released in book form in 1951 (being later re-issued in 1963). Adamski's supposed encounters took place in late 1952/early 1953. To paraphrase the original correspondent, I leave you to decide the significance of these facts.

Warlingham *Philip Laskey*
Surrey

Ancient astronauts

In the December/January edition (No 6) you had an article on UFOs in biblical times, which I found fascinating since I am interested in the subject.

For some time now, I have been a member of the A.A.S. (the Ancient Astronaut Society), which is trying to prove that extra-terrestrials visited Earth in prehistoric and biblical times.

For those interested here is the society's address: Ancient Astronaut Society, 1921 St Johns Avenue, Highland Park, Illinois 60035, U.S.A.

How about some binders for keeping space Voyager safe?

Ferndown *S Treasure*
Dorset

Shortfalls

I was interested to read Simon Goodall's comments on special effects in *Close Encounters of the Third Kind* (VOYAGER No 6) as on my first viewing of this film, I thought that I saw stars through the mothership, too, but not having the same opportunity to examine the film closely, I was beginning to think that I had been imaging it!

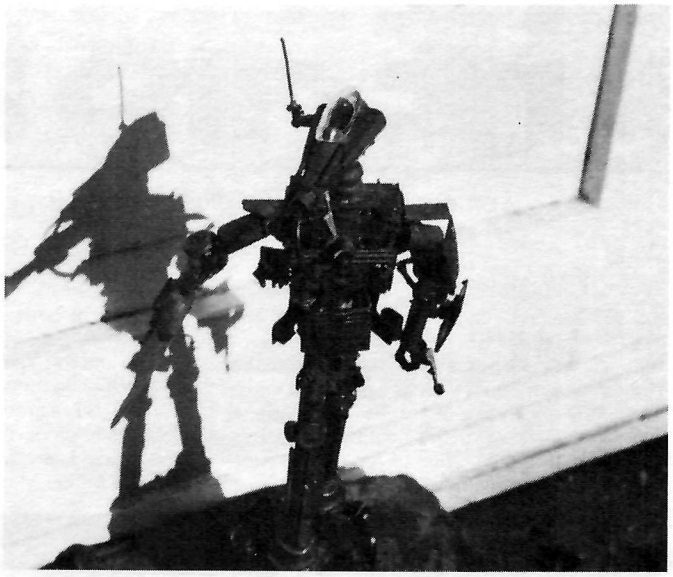
Sadly, there are other examples. One of the most jarring optical deficiencies occurs surprisingly in *Star Wars IV*. The illusion of the rebel and Empire craft flying down the Death Star trench is totally ruined when some of these vehicles explode with a very obvious blue line around the perimeter.

However, even the justifiably famous *2001: A Space Odyssey* is not flawless. Clarke himself admits that Discovery should have been given radiating fins, but comments on the reason for this deliberate omission in *Lost Worlds of 2001*. In that same movie, whilst Dr Floyd is journeying to Clavius Base aboard the Aries IB, he sucks liquidised foods from various receptacles in a tray through tubes. When Floyd removes his mouth, the food slides back into the containers. Of course, in free-fall (zero-g is a misnomer) the liquid should remain in the tubes. Comment is made on this error in Jerome Agel's *The Making of Kubrick's 2001*.

Of these three examples of faults, I would say that the first is repellant and the second is justifiable artistic licence, but the third is inexcusable. We have all learned to live with distortions of the truth in the cinema, but I see no reason to accept such obvious technical falsehoods.

Christ Church *David Lane*
Oxford

Ed: *You're a tough customer to please, David.*



Daniel Goodwin's GALARIAN BATTLE DRONE

Scratch modelling

I enjoy reading you brilliant magazine. My favourite articles are on scratch modelling, so I have sent a photograph of one of my creations. It is a GALARIAN BATTLE DRONE. I hope you like it.

Keep up the good work.

Essendon *Daniel Goodwin*
Hatfield

Close call

A message to pass on to Simon Goodall of Kent.

I wish to point out that after reading your letter about Steven Spielberg's flaws in C.E.3.K., I rushed over to the record player and put on the film's music. I waited to hear the *'Wish Upon a Star'* part. I was about to give up when I heard it. I admit it was slowly played and mixed up with the other music, but after listening to this part about 15 times, I made up my mind that this was the music I was listening for. I suggest you listen again.

As for Simon's pointing out of 'reflections' and so forth, I'd like to remind him that Steven Spielberg (although he doesn't always seem like it) is only human (he will be relieved to learn that, ed). After saying that, however, whilst watching the making of *Raiders of the Lost Ark*, the narrator (I think it was Harrison Ford) pointed out that when Indiana fell in the well of souls and was face to tongue with a snake, a reflection could be seen over Indiana's left shoulder. This reflection of the snake was caused by the sheet of glass between Harrison Ford and the snake. When I went to see *Raiders*, I looked for this, but the scene was so short that I could not make it out in time.

I'm sure though that Steven Spielberg fans like me would not worry about such minor flaws and watch his films as true fans, not as critics.

Trowbridge *Carol Griffin*
Wilts

Ed: *Hear! hear! Let's get back to enjoying films instead of taking them apart frame by frame to find all their piddling little errors!*

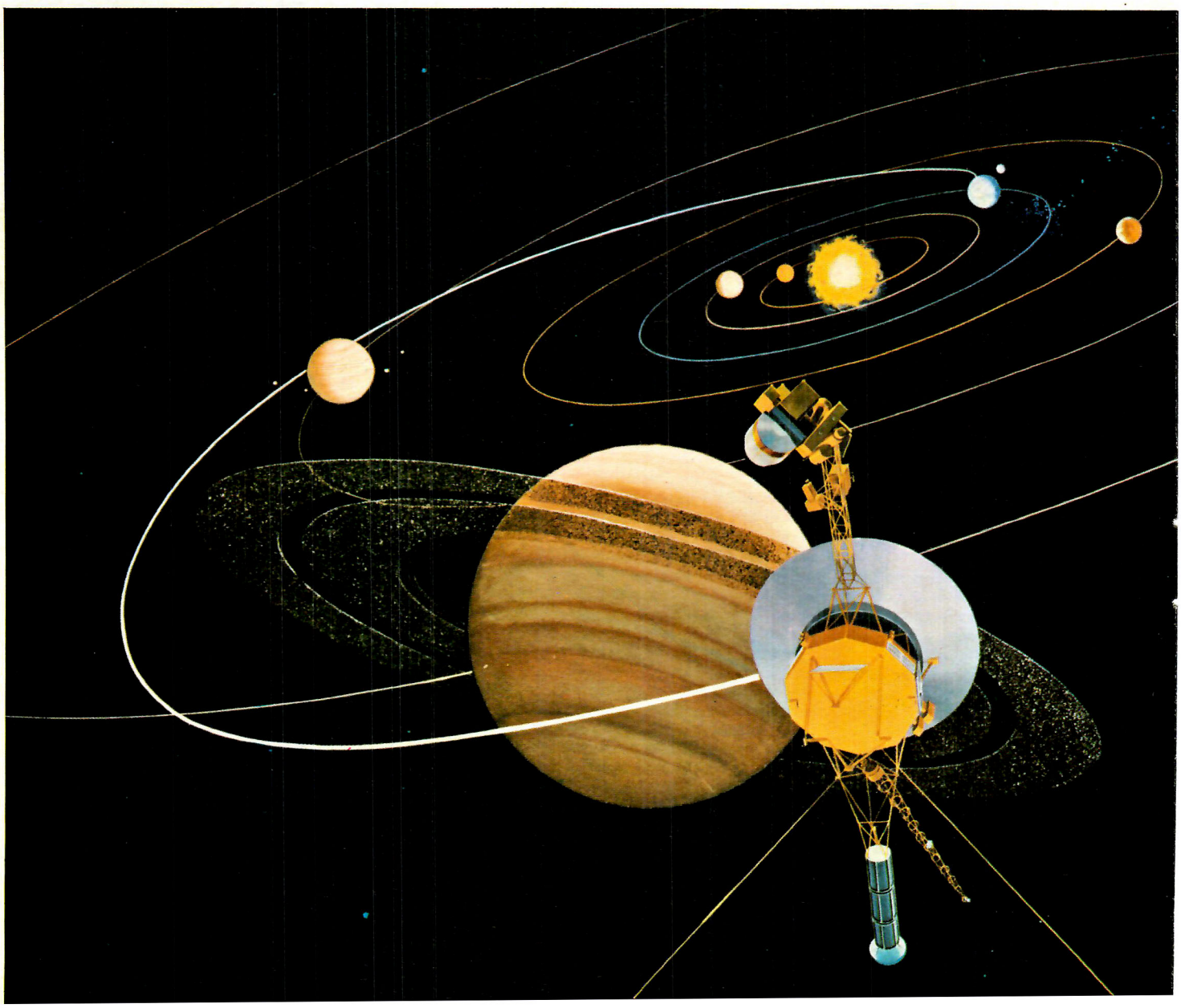
NASA
THE FIRST 25 YEARS

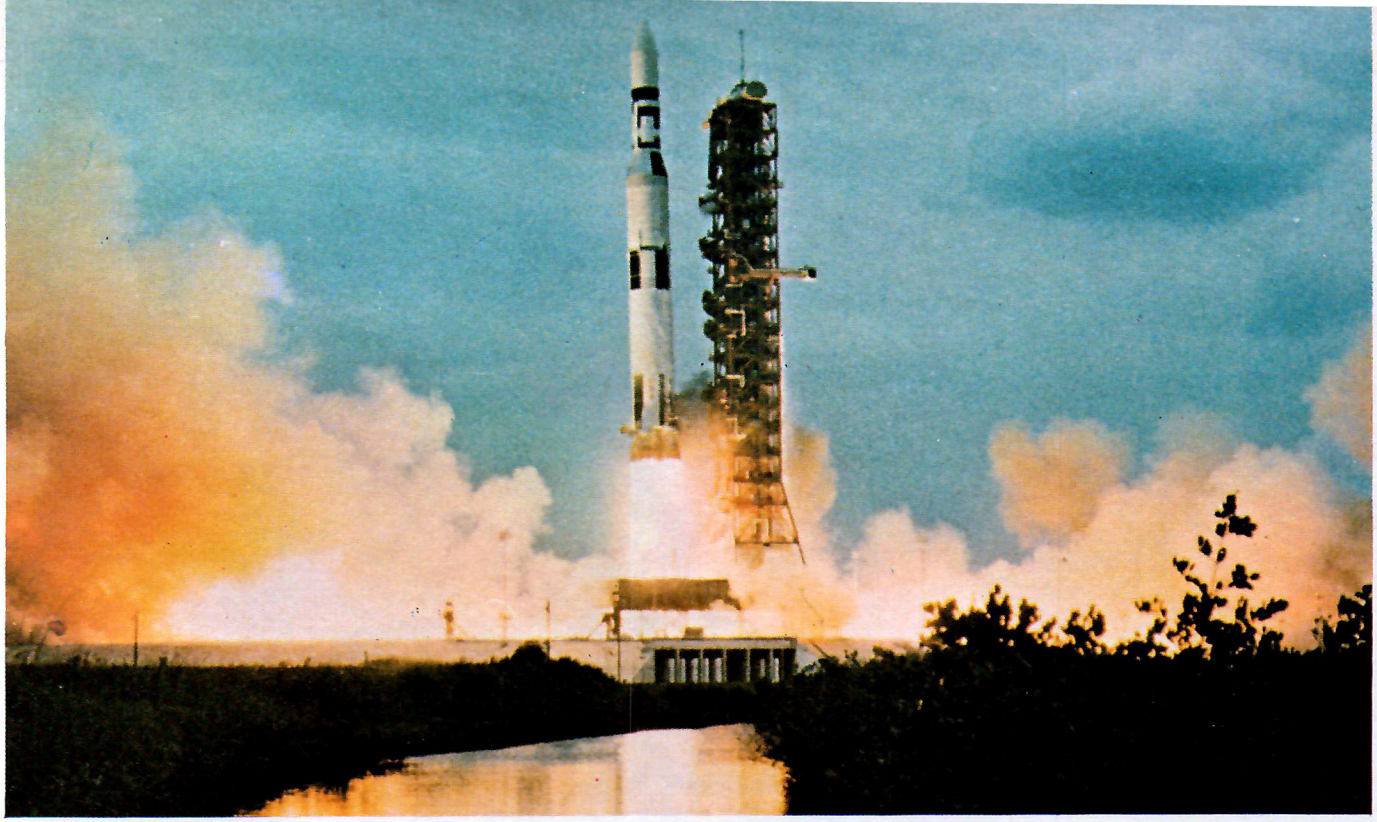
AMERICA'S SPACE AGENCY HAS JUST CELEBRATED ITS FIRST QUARTER CENTURY
WE LOOK BACK ON ITS ACHIEVEMENTS

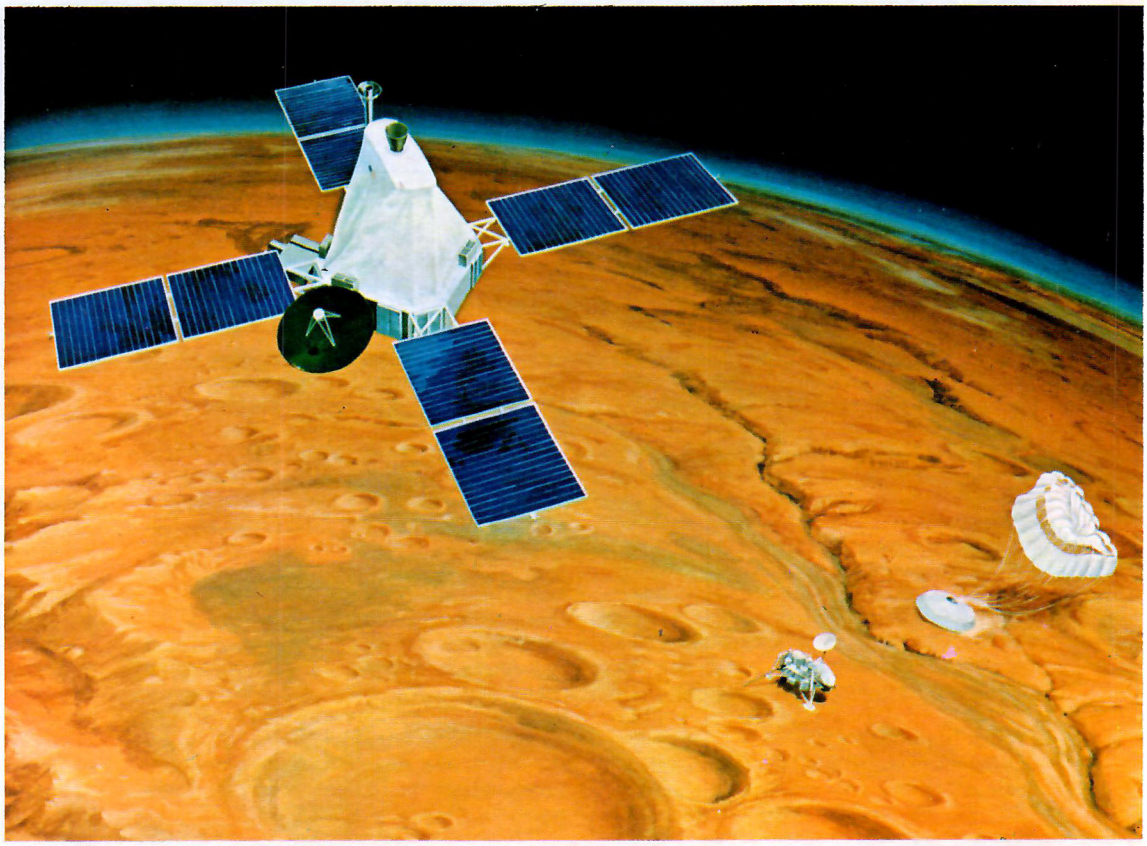
On the first day of October 1958, the National Advisory Committee for Aeronautics (NACA) passed into history and the National Aeronautics and Space Administration (NASA) was born. Its birth was a turbulent affair, with the military authorities reluctant to see the future of America's space effort lie with a civilian agency.

Despite its hesitant beginnings, it has been in existence now for just over a quarter of a century and this seems as good a time as any to review its activities. Since that October day in 1958, 12 astronauts have walked on the Moon and dozens of astronauts and scientists have worked in low Earth orbit. The planets Mercury, Venus, Mars, Jupiter and Saturn have been explored by unmanned probes. The hundreds of communications satellites that have been launched allow us to see events anywhere on Earth. Whole industries have grown up to serve the space business.

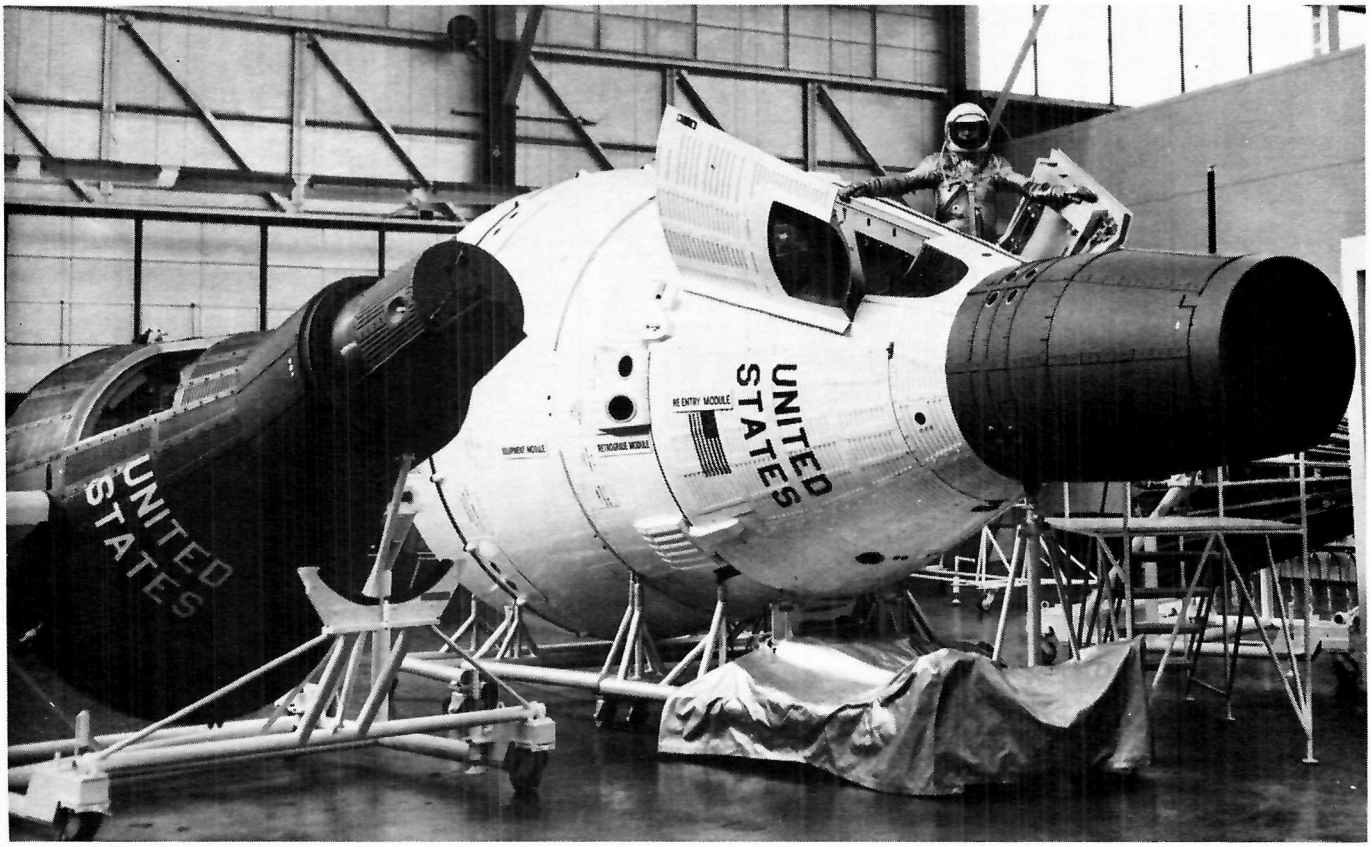
By the time NASA came into being, America's first two satellites, Explorer 1 and Vanguard 1, were already in orbit. Between its







Left: In this artist's impression, Voyager 2 is flying by Saturn (in 1981), having used the enormous gravitational pull of Jupiter to send it on its way. Top: The Saturn 5 rocket, designed by Dr Wernher von Braun, would take six Apollo crews to the Moon. Above: This artist's impression shows a Viking Orbiter over-flying the Martian surface, on which a Lander is sitting, with its parachute and shield nearby. Photos: NASA.



NASA's first two manned spacecraft stand side by side. Gemini (right), at three tons, is almost twice the size of Mercury. Photo: NASA.

formation and May 1961, NASA launched a number of important satellites. In August 1959, Explorer 6 sent back the first photograph of the Earth. The TIROS project developed techniques for weather forecasting by satellite. TIROS stands for Television and Infra-Red Observation Satellite. TIROS 1 was launched on April Fool's Day (no significance) 1960.

MIDAS 2 (Missile Defence Alarm System), launched in May 1960, carried infra-red detectors capable of registering the hot exhaust of an intercontinental missile, doubling the warning time of a missile attack. Transit, the first navigational satellite, began operating in June 1960. Discoverer 13, launched in August 1960, brought success to a project that had been dogged with failure. It ejected a capsule on its seventeenth orbit and the capsule was recovered from the sea.

Project Mercury

But the event that made NASA a household name all over the world took place on May 5th 1961. On that day, Alan Shepard caught the world's imagination by becoming the first American to reach space. Close on the heels of Yuri Gagarin's orbital flight in the previous month, Shepard made a sub-orbital hop in his Mercury spacecraft. The flight took only 15 minutes. The craft, made by McDonnell, would carry six Americans into space. The first to make an orbital flight was the current Presidential candidate, John Glenn, in February 1962.

Mercury proved that astronauts could be placed in orbit and returned to Earth. The ultimate aim was to fulfill President Kennedy's challenge, to send a man to the Moon and return him safely to the Earth by the end of the decade. That was a heck of a challenge, when you think that he made it only three weeks after Shepard's 15 minute rocket ride! But before the Moon landing project could begin, NASA would have to rehearse all of the manoeuvres necessary to get the spacecraft into orbit round the Earth, then for the first time to break out of Earth orbit and head for the Moon, where another complicated procedure would be necessary to get the craft down onto the surface. Then the crew had to be brought home again.

Twins in orbit

The intermediary programme of flights designed to test all these procedures and a good deal of the hardware required was dubbed Project Gemini. The spacecraft, which weighed twice as much as a Mercury capsule, didn't fly for two years after the last Mercury. But once the programme started, it moved along very quickly indeed. The 10 Geminis were launched at the rate of five per year.

The two-man Gemini gave 20 astronauts invaluable experience of docking, space-walking, the use of target vehicles for propulsion and guided re-entry. It was the first spacecraft to use a vital British development, the fuel cell, to generate electrical power by combining hydrogen and oxygen, with drinking water as a by-product. Mercury 9 had been the longest duration American flight at 22 orbits lasting just over an hour. Gemini 7, crewed by Frank Borman and James Lovell, increased that to 206 orbits lasting a fraction under a fortnight. Geminis paved the way for the Moon-landing programme – Apollo.

Tragic start

Gemini had gone extremely well, although there were causes for concern. Gemini 4's onboard computer failed and Jim McDivitt had to make a manual re-entry. Gemini 8 docked with an Agena target rocket, but then a stuck thruster rocket started the two vehicles spinning, causing a premature undocking and return to Earth. Despite these relatively minor setbacks, NASA was riding high on its successes, which had overtaken the sluggish Soviet manned programme.

Development of the Apollo Command and Service Modules by North American Rockwell and of the Lunar Module by Grumman Aircraft made extremely good progress. In May 1964, an unmanned Apollo Command Module was successfully placed in orbit. The first flight crew began rehearsing spacecraft procedures. On January 27th 1967, astronauts Grissom, Chaffee and White were bolted into their Module for a launch rehearsal. An electrical arc in the spacecraft ignited the 100% oxygen atmosphere. Despite frantic attempts by technicians to release the crew, they were dead when the hatch was opened. Over the next 18 months, the spacecraft was radically redesigned, particularly in respect of the hatch and atmosphere. A quick release hatch was fitted and the atmosphere was changed to a 60/40 oxygen/nitrogen atmosphere during ground tests and launch, gradually changing to 100% oxygen.

Apollo gets going

The Apollo/Saturn combination was tested by

Apollo 7, the first manned Apollo. Apollo 8 was the first manned spacecraft to leave Earth orbit and head out into deep space. Borman, Lovell and Anders flew round the Moon, spending 20 hours in orbit there, at Christmas 1968. The Lunar Module was first carried on Apollo 9. Apollo 10 took the crew to within 14.5 kilometres of the lunar surface. It set the scene for the first Moon landing only two months later. Twelve astronauts from six Apollos walked on the Moon and brought samples of Moon rocks and soil back to Earth.

Apollo 13 nearly ended in disaster when an oxygen tank in the Service Module exploded more than 200 000 miles from Earth. The Moon landing was aborted and the main objective became simply getting the crew back alive. It's not too dramatic to say that the world held its breath, as millions of people here on Earth tuned into the regular news bulletins that reported on the crippled spacecraft's progress.

The spacecraft swung around the back of the Moon and headed for home. Conditions inside were miserable. It was cold and dark. The tiny speck of humanity in the vast blackness of space watched the Earth grow larger over the next three days . . . and hoped. The Lunar Module, which had served as their lifeboat, was cut adrift only three and a half hours before splashdown.

No-one, including the crew, knew whether the explosion in space had damaged their heat shield. As the Command Module re-entered, there was radio silence. After what seemed like an age, it dropped through the clouds within sight of the television cameras and millions of viewers. James Lovell, John Swigert and Fred Haise received an enthusiastic welcome home.

Post-Apollo

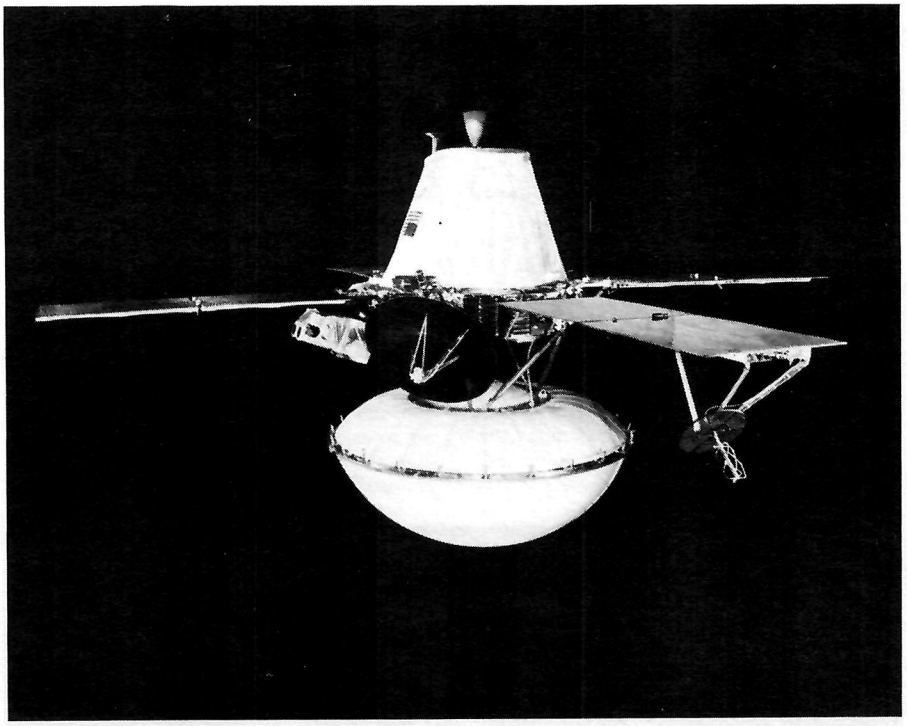
Apollo was succeeded by Skylab, an orbiting workshop, but Skylab and the three crews who kept it operational for 171 days never attracted the public interest that Apollo did, with its mind-boggling objective of placing human beings on another world. However, Skylab provided valuable data on long duration flights, working in a weightless environment and many of the techniques to be adopted later by Space Shuttle crews.

In the post-Apollo period, unmanned spacecraft stole the limelight. Viking, Voyager and Pioneer explored many of the solar system's planets. Mariner 9 had sent back impressive views of Mars in 1971/2, but they were quickly forgotten when colour pictures from the surface of the red planet were sent back by the two Viking Landers in 1976. Viking was an automatic laboratory, the Lander, attached for most of its flight to an Orbiter. The Orbiter's solar panels provided power for both parts of the craft until they separated, when the Lander's nuclear batteries were activated.

It was hoped that Viking might prove once and for all whether there was any life on Mars, but the results from its experiments were at best inconclusive. One experiment to measure the respiration of anything living in the Martian soil yielded positive results. However, the results could equally well have been produced by an entirely inorganic reaction.

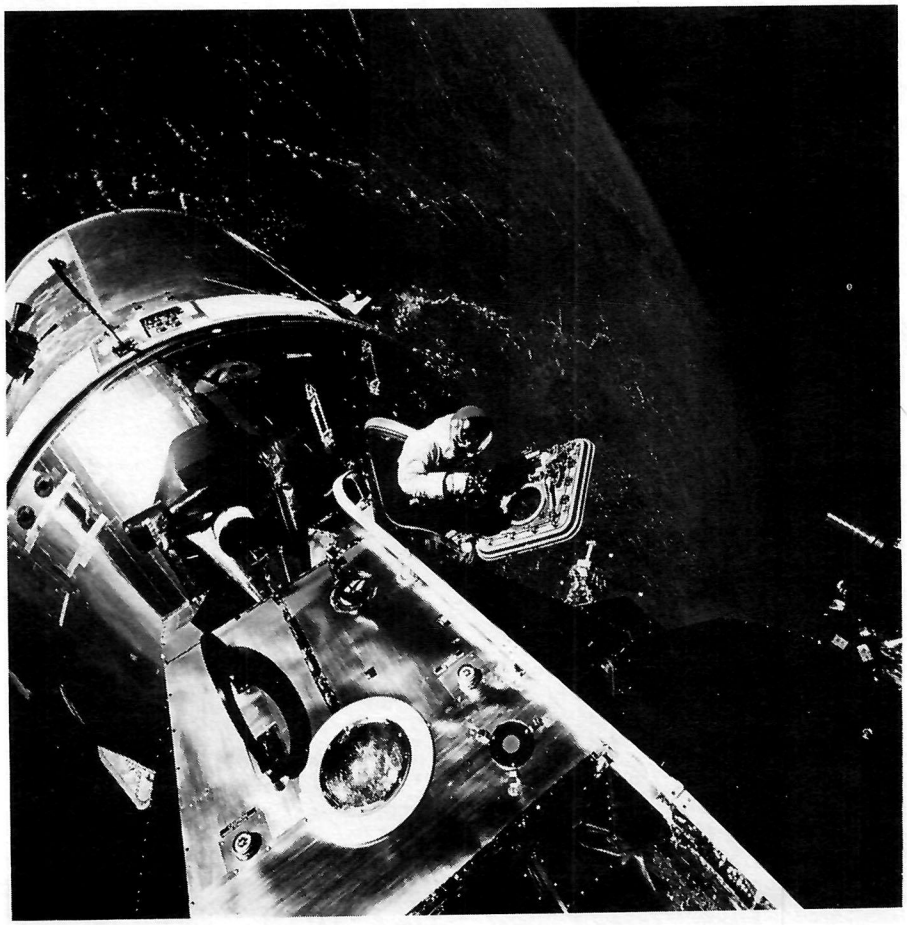
Even more impressive were the views of Jupiter and Saturn transmitted by the Voyagers and Pioneers. These were extremely successful spacecraft. They survived asteroids and intense radiation to surpass the wildest expectations of their designers

The Voyagers were the fastest man-made



The Viking spacecraft is composed of an Orbiter, with four solar panel arrays, and a Lander, protected by a shield. Photo: NASA.

Below: Russell Schweikart took this picture of David Scott from the hatch of the Lunar Module. Scott is emerging from the Apollo 9 Command Module hatch. Photo: NASA.



objects to leave the Earth. They reached the Moon's orbit in only 10 hours, something which had taken three days by Apollo. The two Voyagers reached their first objective, Jupiter, in 1979. Using its immense gravitational pull, they were swung on towards Saturn and the outer planets.

Two Pioneers (10 and 11) had already visited Jupiter in 1973 and 1974, proving that the long and dangerous flight was possible. Pioneer 11 was renamed Pioneer Saturn when it later encountered that planet.

Spaceplanes

The idea of a vehicle that could take off from Earth, fly into space and return to Earth again, perhaps landing like an airliner, seems like science fiction to many people even now. The X-15 rocket-powered aircraft had come very close to that, but it was a secret project and its pilots received none of the public acclaim that surrounded NASA's astronauts. The Space Shuttle was a great step forward in space technology, especially in the area of propulsion. The Shuttle's main engine is the most advanced liquid fuel rocket engine in use today. At full power, they release power equivalent to 23 Hoover Dams, yet they're only five feet tall!

NASA first considered a single craft capable of taking off and achieving orbit by rocket power and then landing back on Earth under jet power. That gradually evolved as a result of financial and military pressures into the Space Shuttle that we have now – a compromise between re-usability and one-shot hardware. The Shuttle Orbiter and solid rocket boosters are re-usable, but the external fuel tank used during launch is allowed to break up in the atmosphere when its job is done. There is also no jet power for landing – the Orbiter lands like an 80 ton glider.

The Shuttle project was at first linked to a space station project, but when NASA saw the possibility that they might lose both projects, they began to campaign for the Space Shuttle project for its own worth, drastically cutting the costs of future manned programmes.

The first Orbiter, Enterprise, was tested in the atmosphere in 1977. It was piloted by Fred Haise, a survivor of Apollo 13, and Gordon Fullerton. Enterprise was not fitted with engines, and so a 747 Jumbo jet was used to get it airborne. The tests proved that the stubby Delta-winged Orbiter could be flown in the atmosphere and landed safely.

And on to orbit

Columbia roared off into a blue Florida sky in April 1981. The speed of its take-off surprised seasoned launch watchers. John Young, perhaps the most experienced astronaut, commanded the mission, with pilot Bob Crippen. It proved that the Shuttle system worked. Since then there have been a further eight flights by both Columbia and the second Orbiter Challenger. They have launched satellites, carried out hundreds of experiments, taken thousands of photographs of the Earth and carried the European orbiting laboratory Spacelab into orbit. In a few years, a fleet of Orbiters could be making 50 flights per year.

Where does NASA go?

Does NASA carry on operating the Shuttle forever more? Are there any major projects coming up? Well, space is gradually coming back into the political debating arena, largely as a result of John Glenn entering the race for the Presidency. His campaign stresses his adventuring past, reaching for new frontiers and succeeding. Space is becoming fashionable again and that means that financial support for projects should be more readily available.

Several projects are on NASA's short-list for the next decade. The Galileo unmanned exploration of Jupiter and its moons will go ahead. But manned projects are less clear. Maybe it will be a permanent lunar base, maybe a manned mission to Mars, but I feel that the most likely candidate, on the heels of Spacelab's success and in the face of increased Soviet activities in space station technology, is a large permanently manned space station structure. Europe is sure to be involved in a big way. So, NASA may get its way in the end, of having a permanent space station served by a fleet of Space Shuttles.

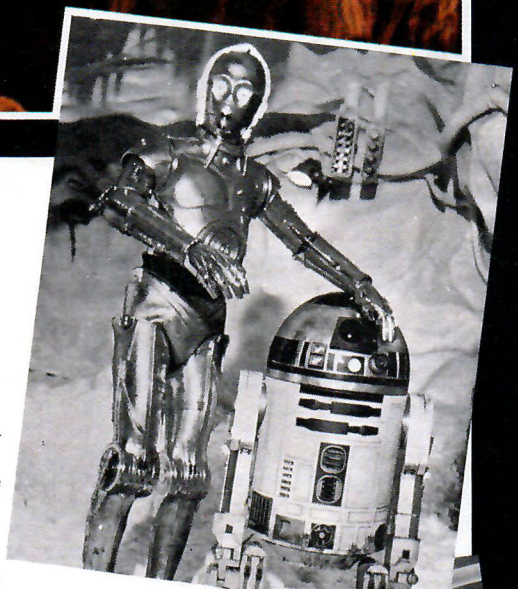
Since NASA is essentially a research and development agency, it is unlikely to carry on operating the Shuttle for more than the first few years of its working life. Plans are probably already in hand to transfer Shuttle operations into private hands, once it becomes a routine commercial tool.

The big question is – will NASA's next 25 years be a exciting, innovative and ambitious as the first 25?

Edwin 'Buzz' Aldrin stands on the Moon's surface during Apollo 11, the first Moon landing mission. He described the scene as 'magnificent desolation'. Photo: NASA.

THE TRILOGY TEST

SO YOU THINK YOU KNOW YOUR STAR WARS TRILOGY. SIMON GOODALL HAS PUT TOGETHER THIS PRETTY STIFF TEST OF YOUR 'LUCAS QUOTIENT' (ANSWERS ON PAGE 63 – DON'T CHEAT!!).



Star Wars

1. How many episodes are there in the entire Star Wars story?
2. Name the last remnant of the old Republic that is disbanded in Star Wars.
3. On which planet was the Rebel headquarters before the events of Star Wars?
4. What is the name of Luke's farm on Tatooine?
5. What did the Millenium Falcon achieve in less than 12 parsecs?
6. Name the creature that attacks Luke in the waste chute aboard the Death Star.
7. Who was R2D2 and C3PO's master before being bought by Uncle Owen?
8. What colour are 2, 3, 5, 6, 7, 10 and 11?
9. Which of the above numbers is adopted?
10. What political figure, missing on Leia's cruiser would have supported her claim that it was a Consular ship?

The Empire Strikes Back

1. In which system is the Rebel Headquarters located?
2. What animal is used by the Rebels as transport?
3. What does A.T.A.T. stand for?
4. On what planet does the Jedi Master dwell?
5. What is cloud city's main industrial function?
6. Who is not likely to get frostbite on the ice planet?
7. Can a Gundark hear?
8. Where do 'Rogues' rest?
9. Who or what goes to pieces over the Rebels dilemma?
10. Who or what gave Luke a hand?

Return of the Jedi

1. Around which moon does the principle action take place?
2. Name Jabba The Hut's pet.
3. Who preceded Admiral Ackbar at the Rebel briefing?
4. To which species is the Admiral attributed?
5. Name the Ewok with two heads.
6. What is Vader's duty aboard the new battle station?
7. How does Leia describe her Mother?
8. For how long has Anakin Skywalker been dominated by the Dark Lord of the Sith?
9. What is the name of the Emperor?
10. Who are not likely to feel the heat of celebration fires?

BRAINSTO

DOUGLAS TRUMBULL'S FILM BRAINSTORM EXPLORES THE FUTURE IMPLICATIONS OF CURRENT RESEARCH IN NEUROSCIENCE

The human body is a maze of organic electrical circuits bathed in the saline pool of the body's fluids. The workhorse of our second industrial revolution, the digital computer, is also a maze of circuits. There have already been primitive attempts to link up man-made computers with the body's own control computer, the brain. A blind woman experienced the sensation of sight when the visual cortex of her brain was stimulated directly by electrodes. The technique was developed to the point where patterns of electric currents from sensors outside the body could be fed into the brain via electrodes implanted inside the brain. The next stage involves coating the perforated electrodes with protein to promote growth of the brain's own protein around and through the electrodes.

Looking a few steps ahead, but not too many years into the future, these techniques will allow data to be taken directly into the brain and after it has been processed by the brain, fed out again to a computer. So, far, we're talking about the relatively simple-to-grasp idea of providing the brain with sensation by replacing the body's sensors with artificial versions, or using currents produced by the brain to control machinery instead of muscles, or generate video displays instead of the sensation of sight.

But, our fickle human emotions can also be represented as patterns of electric currents in the brain. They in turn promote the production of chemical messengers which circulate throughout the body causing the sinking feeling in the stomach associated with fear or the red-faced shaking associated with blind rage. What if the brain of a subject with a blank mind was fed with a pattern of currents that simulated fear? Would the subject feel genuinely afraid – icy fingers around the heart, butterflies in the stomach, nervous perspiration, etc?

Trumbull's film Brainstorm starts off in a laboratory where researchers have found a way of reading the visual, auditory and many other signals produced by the brain. One subject wears a helmet and portapack to read the signals and transmit them to a similar helmet worn by a second subject in another room. The second helmet feeds all of these signals into the second subject's brain. When the first subject eats something, the second tastes it. When the first sees something, so does the second. The signals representing these sensations can also be recorded on a multicoloured foil tape in a machine looking like a do-it-yourself video recorder, which I suppose it is. Natalie Wood successfully miniaturises the hardware, shrinking the helmet with its miles of plumbing and acres of circuitry to the size of a pair of personal hi-fi headphones.

The story is fairly straightforward and unremarkable up this point, but it soon takes an interesting turn. Lilian Reynolds, the chain-smoking head of the research team, played by Louise Fletcher, is outraged to find that the company that funded the research has attracted the interest of the military establishment. The project is about to be classified and handed over to military researchers. Her protests seem to fall on deaf ears. While working alone one evening, the stress caused by a minor accident finally breaks her system. She suffers a heart attack. Knowing that she cannot summon help, she does a remarkable thing – she puts on one of the headsets and switches on the recorder. It records her own death.

Now you can see the problem. If the tape is played back into a headset worn by another person, he will experience everything that has happened to the dead researcher. He will experience someone else's death. The opportunity is too attractive to be passed up. Research assistant Michael Brace, played by Christopher Walken, knows the project inside out. He knows enough to 'tweak' the electronics to lessen the effect of the tape's contents while preserving the imagery captured on it. Unknown to him, though, a second playback studio has been set up, so that the

ORM

Far Left: Michael Brace (Christopher Walken) and an assistant (Jordan Christopher) make some adjustments to their revolutionary invention. Photo MGM/UA. Centre: There are inevitably arguments over the use of such a revolutionary invention! Photo MGM/UA. Above: Karen Brace (Natalie Wood) makes a telephone hook-up by computer with her husband, overlooked by friends (Joe Dorsey and Georgianne Walken). Photo MGM/UA.

military research team can duplicate everything carried out in the laboratory. When Brace starts the tape, the military eavesdropper, also wearing a headset is unprotected. He receives the full force of the playback and suffers the same massive heart attack as Lilian Reynolds.

Now the military grasp of the project tightens. Brace is excluded from the lab and unable to finish playing the tape. Like any computer nut worth his salt, he devises a way of breaking the firm's security codes and gaining access to the computer files by telephone from a remote terminal. He discovers that the project file, now called 'Brainstorm', includes a library of taped experiences. Some of them, described as 'toxic', contain psychotic episodes and the sensations of disturbed minds in general. Brace selects and begins to play one of the tapes, but the experience is so shocking that he rips off the headset in seconds.

He's interrupted and leaves the tape playing through the unattended headset. While away, his young son picks it up and puts it on. He ends up in a hospital bed in a very disturbed state of mind. Brace is now determined to both play the rest of Reynolds' tape and smash the company's military activities. He, an ex-worker and his wife, played by Natalie Wood, join forces to fool the military/company people following them and get round the redoubled computer security measures. And if you want to know if they succeed, you'll have to go and see the film for yourself.

It's an interesting idea, based on current research, played out for the most part in a matter-of-fact way. I liked it for that. Trumbull rejected the awe-inspiring Star Wars high-tech approach and brought just as much technology into the production as was necessary to tell the story – perhaps more due to budgetary restrictions than artistic discretion. Clever editing made one or two of the simple special effects all the more effective. The film doesn't shy away from showing what the 'death' or 'psychotic' tapes contain. And the running battle between Brace and the company's military researchers over project Brainstorm is at times engaging. Brainstorm isn't a blockbuster, but I didn't feel that I'd wasted my time in watching it.

Right: Michael Brace (Christopher Walken) is amused by his wife's (Natalie Wood) reactions to a startling new invention as his co-workers (Joe Dorsey, Louise Fletcher and Cliff Robertson) look on. Photo MGM/UA.

S-F ON VIDEO

IN THIS NEW REGULAR COLUMN, MARK GORTON CASTS A CRITICAL SCIENCE FICTION EYE OVER IS VIDEO CHOICE.

Welcome to Space VOYAGER's new video column in which I'll be focusing a critical eye on science fiction and fantasy videos. Fortunately for SF fans there's already a pretty extensive library to choose from. Some of the titles are recent major productions now available on tape and, in some cases, disc, and they won't need much comment on my part. On the other hand, older SF films and recent efforts which never made it to your cinema will be less familiar, and I'll try to review them as accurately and fairly as I can, to help you make up your mind whether or not to rent, or even buy.

All the videos, however, will be given a *Space VOYAGER* rating:

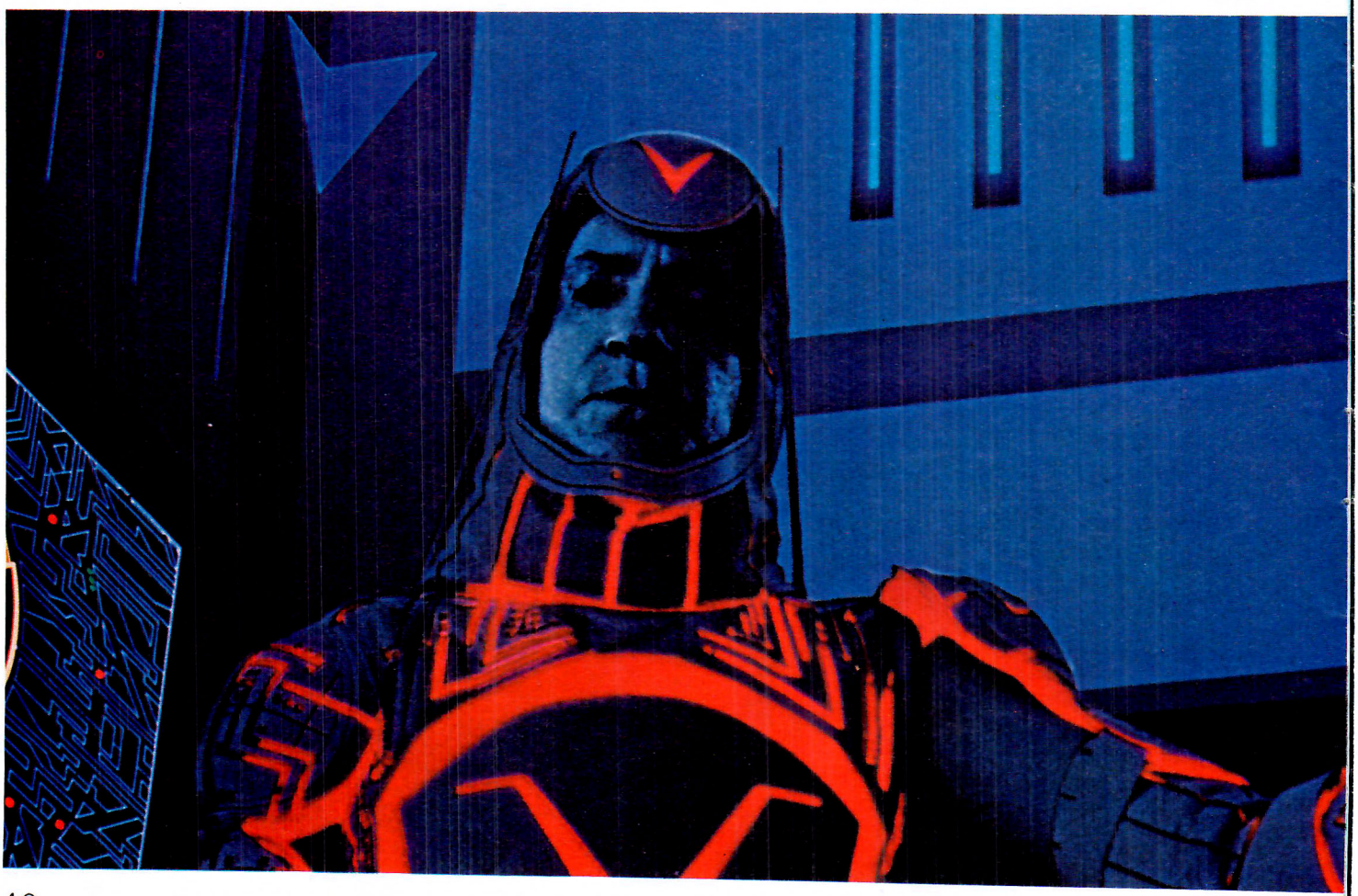
* Poor
** Not So Bad
*** Good
**** Outstanding

There'll also be a special rating (●) the awesome black hole which will be awarded to any video so mediocre that a black hole, from which nothing can escape, would be the best place for it. And since it's unhappily true that, in the name of science fiction, film producers have hatched more than a few turkeys, I fear I may be forced to unleash the black hole's terrific forces every now and again... So in future turn to these pages with care!

But now it's fast forward to the videos.

BLADE RUNNER, Ridley Scott's adaptation of the late Philip K Dick's novel, *Do Androids Dream of Electric Sheep?,* is a grim, 2020s vision of the future which mixes the latest in special effects with the cinematic conventions of 1940s *film noir*. The result is a trip through a sort of science fiction Chandlertown, where Harrison Ford plays Rick Deckard, the blade runner of the title, namely a bounty hunter paid to terminate renegade 'replicants' – androids made to carry out dangerous and unpleasant tasks. It's a flawed movie, apparently butchered by studio bosses worried by its length and original downbeat ending; and the theme – that a mechanistic future threatens our humanity – is hardly new to SF. Nevertheless, this is probably the most thoughtfully wrought picture of the future ever seen on our

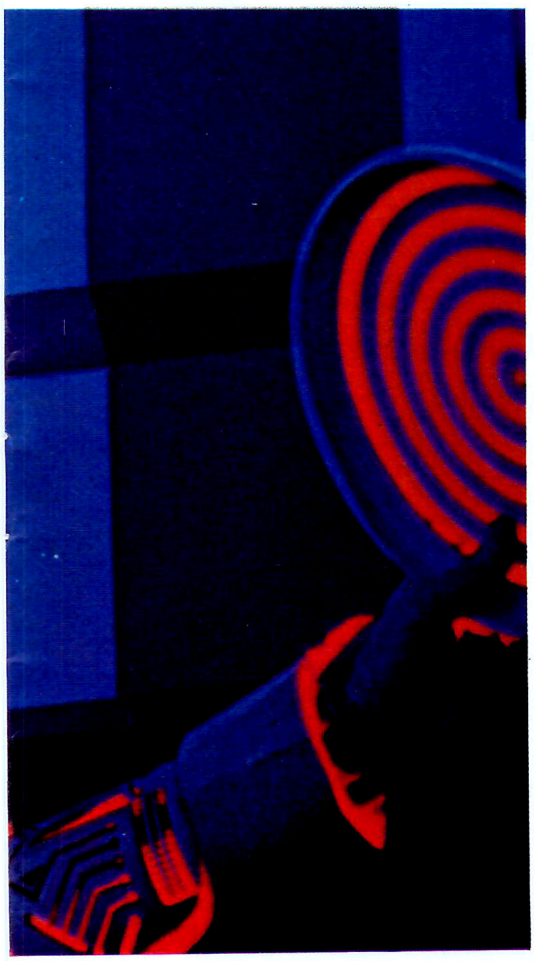
Below: Villian of the piece, Sark (played by David Warner), will stop at nothing to protect his own interests in the futuristic world of Tron. Photo: © Walt Disney Productions.
Far Right: A city scene from Blade Runner. Photo: Columbia-EMI-Warner.



screens, and there are moments of genuine unease and pathos despite a comic-strip script. In short, **BLADE RUNNER** is well worth seeing, and may be a good first buy if you fancy starting an SF video library of your own. And as for the rating:

BLADE RUNNER: ***

Next, **TIMERIDER,** which emitted a muffled gobbling sound as I read the cover blurb: 'A journey in time which leads to a great many thrilling adventures including a steamy encounter with great-great-grandma – conducted at gunpoint'.



Hmmmmm, the gobbling grew louder. . .

The 'plot' of **TIMERIDER** whisks motorcycling champion Lyle Swann into the past when he rides through a time-travel experiment. Finding himself in 1877, Lyle naturally creates anachronistic havoc, which begins when his visored helmet and roaring bike scare an old man to death.

Lucky for the old man, I say, because he doesn't have to sit through the rest of the video. The blurb's promise of many 'thrilling adventures' is not kept; in fact this is one of the most padded movies I've ever seen, taking 90 minutes to tell a 15 minute story. It looks for all the world as if the director began making a western, got bored, and decided to make a science fiction film instead. What's more, on my copy of **TIMERIDER**, the dialogue was hopelessly out of synch with the actors' lips, which is infuriating, especially when combined with corpse-like acting.

When Lyle runs into trouble with a mean dude who steals his bike *and* great-great-grandma, he enlists the aid of two US marhsalls. There follows an embarrassing scene in which Lyle (who spends most of **TIMERIDER** unaware that he's in the past, despite the appearance and confusion of everyone he meets) mystifies his pardner with words like 'techno toys' and 'silicon valley'. Cringe. . .

Then a scientist from the time experiment is sent to look for Lyle, there's a 'thrilling' climax, and **TIMERIDER** mercifully comes to a halt.

As the credits rolled the gobbling sound grew deafening, and I realised I had viewed a fully-grown turkey.

And I have no hestitation in awarding **TIMERIDER** this rating:

TIMERIDER: ●

TRON was an unsuccessful attempt to appeal to the modern youngster, but is interesting because it perhaps points to the future of animation. Usually animators have to draw and photograph each frame of a cartoon film individually, and when you think that there are 24 frames to every *second* of film action, you can imagine the amount of work involved. **TRON**, however, brought computers to bear on the problem, to tell a tale which, appropriately enough, revolves around programming and computer games. Jeff Bridges plays a programmer who is spirited from the world of the 'users' into the computer-generated world of 'programs'.

Rather like **TIMERIDER**, though, the plot of **TRON** is too slight, and a poor companion to the striking and original computer graphics.

Unusual pictures then, married to an unsatisfactory script, but worth seeing nonetheless. Rating:

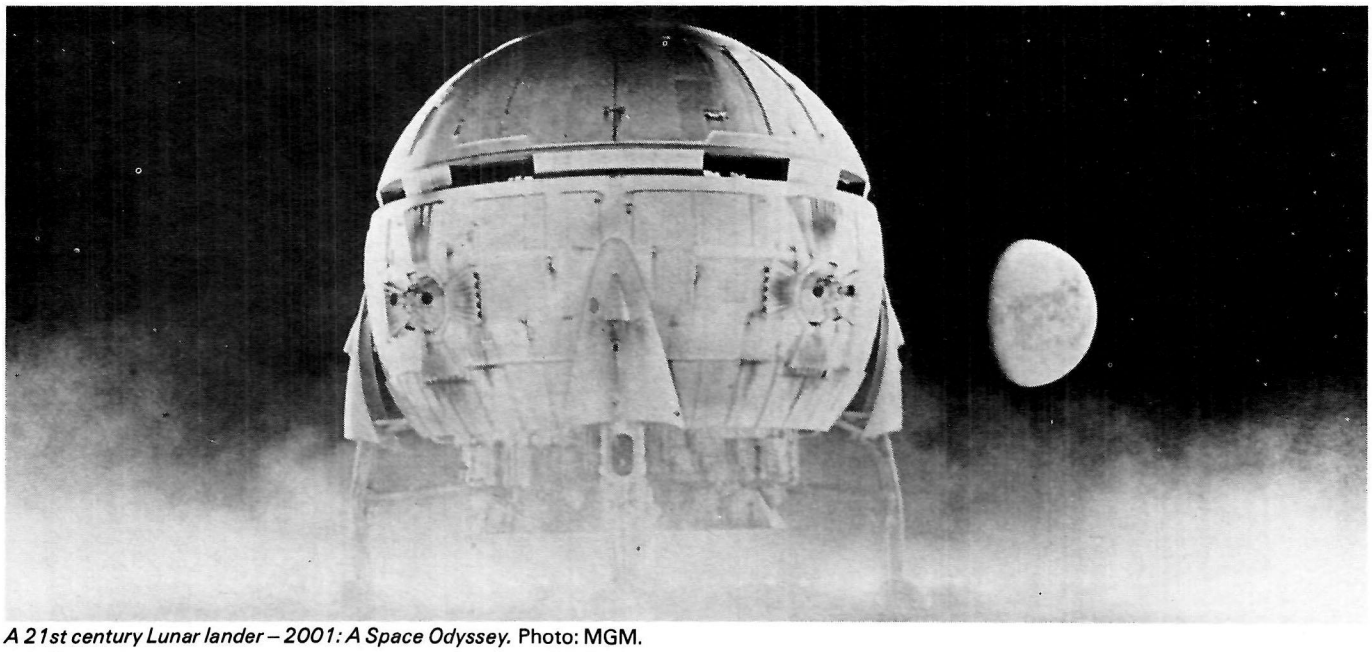
TRON: **

'Cash in and slip up' could well be the motto of **STARSHIP INVASIONS**. To avoid a lawsuit the title had to be changed from *Alien Encounter*, and the movie was zoomed into the cinemas in the wake of **CE3K**. Made in Canada, **STARSHIP INVASIONS** features former *Man from U.N.C.L.E.* Robert Vaughn, and Christopher Lee in a get-up (mandarin robes and a cardinal's hat) which makes him look like a member of the Chinese branch of the Borgia family.

He is, however, the commander of a fleet of spacecraft called the Legion of the Winged Serpent, and they're on the look-out for a new home to replace their dying planet. Meanwhile, back in the Bermuda Triangle (groan), a fleet of interstellar police UFOs has taken up position with a view to foiling Lee's gazumping ambitions. Confrontation eventually becomes inevitable, and the United States Army joins forces with the alien cops, but as a result of Chris Lee's powerful hypnotic influence they start taking pot-shots at their new-found allies.

'Nuff said. This is a poor, fast-buck film, though for those of you interested in special effects, the saucer dog-fights are executed with a good deal of panache. Rating:

STARSHIP INVASIONS: *



A 21st century Lunar lander – 2001: A Space Odyssey. Photo: MGM.

LUNAR S·F

OUR NEAREST NEIGHBOUR, THE MOON, HAS FUELLED THE IMAGINATION OF GENERATIONS OF SF WRITERS. RICHARD AND MARION VAN DER VOORT FOLLOW THE LUNAR THREAD ACROSS THE CENTURIES.

Science fiction and fantasy are the two sides of speculative fiction. The main difference is that science fiction is based on the known science of the time, and fantasy has no rules. One well-known example of science fiction is the *Lensmen* series by E E 'Doc' Smith. The scientists of his time postulated that planets were rare, being formed by the close passage of two stars, so he based his stories on two galaxies, each supporting one intelligence, passing through each other and forming many more planets on which life eventually arose.

The moon is the closest world to us, and a large part of our oral literature, including old wives' tales, feature it. Warts disappear when washed in a silver basin by moonlight; lunatics are crazier at full moon; root vegetables should be planted in the dark of the moon; one should turn over one's money in the light of the new moon – all these and others are not only being remembered and practiced by a small percentage of people but investigated by an even smaller percentage of scientists.

Myths of the horned goddess abound, one of the best known being the Egyptian legends, partly because the culture lasted so long and was preserved so well, partly because the story itself is fascinating. Osiris was the good brother, Set the bad. Set wanted to kill Osiris, but edged weapons would not succeed (either because Osiris was impervious to them, or because it was forbidden to shed the blood of a member of the same family). So Set had a magnificent coffin made to the exact measurements of Osiris. When he climbed in the lid was shut and melted wax poured around the edges so that he would suffocate. Later Set cut up the body into pieces and scattered them far and wide. But Isis, the sister/wife of Osiris, collected the fragments together and then impregnated herself from her husband's dead body, and Horus, the Sun God, was born from Isis, the moon goddess.

By the time of the Greeks, to whom the planets and the home of their gods, Mount Olympus, were equally unreachable, the moon goddess was Diana, the virginal twin sister of Apollo, who drove the chariot of the sun through the heavens every day.

In the Middle Ages, the Church preached that the Heavens were created by God, and were therefore perfect, despite the apparent blemises on the Moon. Then the telescope was invented, and the more intelligent were soon convinced that the moon was a fellow world that circled the Earth, and the Earth, together with the other planets, circled the sun, and science fiction was born.

Cyrano de Bergerac wrote *Other Worlds* in 1650, with himself as the hero. He reasoned that if he hung numerous bottles of dew around himself, as they evaporated he would be drawn towards the moon. This works at first, but after a few hours he notices that the moon is no nearer, so smashes some bottles and descends again, only to find that he has landed in Canada, as the Earth has been rotating beneath him. The rest of his story is more fantastical. He finds the Earthly Paradise in the moon, and is brought back to Earth by a demon. The seeds had been sown, although none of the stories that were written over the next two centuries has survived.

Jules Verne

But then Jules Verne brought out his *scientific romances. From The Earth To The Moon* and *Round the Moon* tell of a half-mile-long cannon, most buried underground, the 'Columbiad' in Florida, from which a three-man projectile is fired. It narrowly misses the moon, goes into orbit, and finally breaks free and lands in the Pacific Ocean. Then H G Wells wrote *First Men in The Moon* in which Professor Cavour invents an anti-gravity alloy and discovers the Selenites hidden under the surface of the moon.

Fantasies were still being published. Edgar Rice Burroughs wrote *The Moon Maid* in 1923, in which a civilisation is again discovered under the surface of the moon, but the story is told in 1967, on the day when Mars and Earth achieve radio communication, and the narrator is telling the story of his next two incarnations!

Another interesting series, dear to me because it first led me to science fiction at the tender age of seven, is the adventures of Doctor Doolittle, written for children by Hugh Lofting. The Doctor is a medical doctor who can communicate with the rest of life on this planet. He is a naturalist, scientist and explorer. Early in the series we learn of Otho Bludge, the cave man in *The Days Before a Moon,* who disappears when part of the Earth is blasted away to form the moon, and finally the Doctor is summoned to a medical consultancy on the moon itself. We learn that there has been peace there for centuries under the Presidency of the only human there, Otho Bludge himself. The creatures are not only bigger than their counterparts on Earth, but they are also immensely long-lived.

Marooned on the moon

In the meantime the use of such instruments as the spectroscope gave us more information about the moon. It seemed to have a surface composed mainly of volcanic ash, no atmosphere and no water. It was obviously a dead world, on this side at least, and only a few hotheads dreamed of visiting it. Indeed Professor Joad, the Carl Sagan of his day, declared that although it might be possible to leave Earth, it would be impossible to get back as our planet is whirling through Space incredibly quickly! That is true, of course, but Joad did not visualise that it would be possible to match this speed easily. Then the Second World War came, and rockets were no longer silly toys but terrible weapons. But still some people saw them as a way of escape from the literally 'mundane' life on Earth.

A new generation of SF writers began to be published. Robert A Heinlein began with *Rocketship Galileo,* published in 1947. No more than a boy's adventure story, it tells of three boys and a man going to the moon, where they discover not only a Nazi base, but the traces of a dead moon civilisation.

John W Campbell Jnr wrote *The Moon is Hell!* in 1951, far more scientifically, but less fun. It is June 15, 1979, and 15 men (no women) have landed on the moon, claiming the farside for America, and spending the next two years in exploration. But the relief ship crashes on landing and they have only food and air for a couple of months. By roasting gypsum for water, which they electrolise to get oxygen, making photocells and digging themselves holes they mostly manage to survive until the relief rocket comes in 1982.

Heinlein towers over the 1950s with his novels and short stories from *Space Family Stone* in 1952 to *The Menace From Earth* in 1959. He wrote very readable thrillers with a scientific basis, which are still in print. Despite his interest in people, his glimpses of the moon are interesting, and most consistent. In *Blow-Ups Happen* he suggests that the moon was once a living world that destroyed itself when its power plants exploded, but after that we meet only humans 'in' the moon, living in underground tunnels. They mine oxygen and water in a sterile atmosphere, endangered by moon quakes, but on the whole 'Lunatics' heart and soul, preferring the moon to the dirty, wet, messy Earth life, with its heavier gravity. In *Double Star* the Imperial Capital, New Batavia, is on the moon. In *Space Family Stone* the younger generation at least are fully at home.

But some of Heinlein's competitors are also still in print. British author John Wyndham in *The Outward Urge* visualises the Big Powers on Earth starting an atomic war, and only the British moonbase surviving because it is unarmed. This was written in 1959, about events in 2044. Arthur C Clarke in *The City and the Stars* (1956) shows us the site of the great weapon that destroyed the moon when it drew so near to Earth that it started to disintegrate. In 1961, in *A Fall of Moondust* he tells of the accident to the tourist Dust-Cruiser 'Selene', and later in *The Sentinel* he sows the seed for the film *2001* with the device found on the moon that sends signals out to some unknown hearer.

Mammalian eclipse

In complete contrast another British author, Brian Aldiss, wrote *Hothouse,* a fantasy of the far future. In it, the braking action of the moon has brought the Earth to a standstill. Also, the moon has slipped back to a Trojan position between the Earth and Sun, and increasingly hard radiation from the Sun has meant the eclipse of mammalian life, including man, and the rise of the vegetable kingdom.

Another fantasy writer, Zenna Henderson, devoted herself to tales of aliens close enough to mankind to inter-breed, who take refuge here and discover that some of us have equivalent psychic gifts. She wrote *The People – No Different Flesh* in 1966, in which a group of her aliens take a human ship to the moon. In the same year *The Moon is a Harsh Mistress* was published, perhaps Heinlein's best book, in which the moon is a penal colony and the people want and need freedom from a tyrannical Earth. Told from the point of view of a born and bred 'Lunatic' we see people who do not want to return to their 'native' planet, but instead want to live their chosen life without inteference.

But already the first pictures of the farside of the moon had been seen, and in 1969 a few men actually walked on our sister world, but not very far. Some puzzles were solved, but more took their place, and the moon programme was given up in 1972, with apparently the end of SF about it. We did know more – that the moon has been slowing down Earth's rotation, but is moving further away from us, that there was once a period of intense volcanic activity, but there is certainly no water or atmosphere, and that there has never been life there. The facts seem as black and white as the surface of the moon itself, so what could be left to write about?

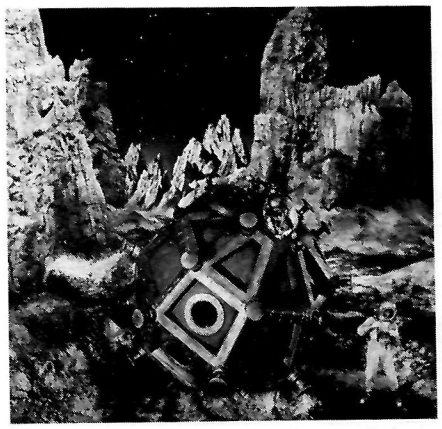
In the latter half of the 1970's a new lease of life came to stories about the moon. James P Hogan wrote *Inherit The Stars* about a fifty thousand year old corpse found in a spacesuit on the moon. It not only gives us a good theory to explain why the farside and the nearside are so different, but it's a well-spun yarn. The asteroid belt was once a planet, Minerva, which destroyed itself in war, and its moon, set free to wander in space, was finally attached to Earth.

Space invaders

John Varley began his stories of *The Invaders* taking Earth from mankind and banishing them to the moon, where they live mostly on the farside, in an entirely different culture, where people change sex easily and often, the Central Computer runs most things, and people are allowed only one child each. It isn't an ideal society, anarchists abound, and there is even a religious sect which attracts the seeds of destruction. What is more, these stories were mostly published first in magazines, like the old days.

Sam Nicholson also wrote a series of stories for Analog that were collected together by **Ace** as *Captain Imperical,* which describe the setting up of a moonbase, and Larry Niven has written some stories, including *The Patchwork Girl* a Lunar detective story. Just out in paperback is Bob Shaw's *The Ceres Solution* in which the moon is our second-worst enemy. So the moon is still alive in SF, as well as fantasy.

In real life the moon appears to be out of bounds again. No more exploring expeditions are planned, not even a permanently manned moonbase, preferably on the farside, away from all of the Earth's confusing output, something that would make these tales as old-fashioned as Rider Haggard's yarns seem to us today. We've got the message – there is no life on the moon, but we don't have to accept it, we can follow our traditions, and create life there ourselves. And what's next? Mars, of course



The First Men in the Moon, with a little help from Cavorite – British of course.
Photo: Columbia.

Méliès' interpretation of Jules Verne's From the Earth to the Moon.

SPACE INDUSTRY

FUTURES CORRESPONDENT ANDREW NIMMO DUSTS OFF HIS CRYSTAL BALL FOR A RADICAL FORAY INTO THE FUTURE INDUSTRIALISATION OF SPACE.

It's go! GO! GO! – for a new space era. As a result of 70 or so experiments carried out in Spacelab, and one or two which were carried out on earlier spaceflights, it now seems that many new alloys and materials, larger and purer lenses and mirrors than can be made on Earth, pure macro crystals or crystals flawed more or less to order for computer applications, cheap insulin, cures for cancer and cardiovascular diseases, and much much more may soon be possible.

Foamed metals could be used to build cars which would last for 500 000 miles! New knowledge of lubrication from fluid experiments could make this even longer. New lenses and mirrors could not only enable the military to manufacture laser weapons, but could also help projects to beam down energy from Solar Power Satellites, and would be a boon to astronomers and many others. Macrochips from crystal growth experiments could create mainframe computers on a single chip more complex than a human brain, yet small enough to be placed in, and to control a walking, talking robot. The first C3PO will not be a caricature of a man, he will be more intelligent than we are! All he will lack is emotion, so Isaac Asimov's laws will have to be built-in to give at least some semblance of this. Further, if we learn how to cure not only diabetes, but only cancers and blood problems, we will be well on the way towards nothing less than immortality!

Events may not unfold quite like this, but there is very strong evidence for most of it. There can be no doubt whatsoever that Spacelab presages a renaissance of awe-inspiring proportions. Humanity is about to change into a race of what will be difficult to describe as anything but 'gods'.

Before all this can transpire of course, much longer flights will be necessary. Economic processing of large quantities of anything is not likely to be accomplished on a week-long Spacelab flight. To answer this, on 15th April 1982 ESA approved a new project entitled 'Eureca'. The first Eureca flight is scheduled for 1986. It will be a more advanced version of Spacelab, able to carry payloads of up to 1500 kg, and unlike Spacelab, it will have its own rocket motors. Once in orbit after launch by US Space Shuttle, it will be released from the Shuttle and will then power its own way up to a higher orbit, where it will stay for six months, then it will descend to the Shuttle orbit again, where it will be picked up and brought back down to Earth. Experiments are already queuing up for this flight as it will also be capable of being used for real processing as opposed to research only.

There will be several other Spacelab flights and also more Eureca flights, but for worthwhile processing we are going to need the facility to make processing routine. This is what the 'Spacelab' project approved by President Reagan will do. This will be a permanently manned space habitation. For some time, ESA have also been planning for such a possibility. Their idea is to link together a number of Spacelabs or Eurecas. Russia has also been preparing for a permanent space station, with their Salyut craft, and the Chinese have announced their intention to build a space station. It is therefore virtually certain that such stations will be built within the next decade or two, and true space industrial processing will commence.

There is still one major snag though. What comes down must first go up, unless space industry makes use of what is already up there, and it is the cost of launch from Earth which is the most expensive part of spaceflight. This being the case, it's worth considering what *is* up there. In terms of energy, the nearest place off Earth where there may be something worthwhile is either the L4 or L5 point. The 'L' points, named after the French mathematician Lagrange who discovered them, are points where the Earth's and Moon's gravities balance. As L4 and L5 (60° behind and ahead of the Moon on the same orbit (are the most stable of those points, there is just a chance some small rocks may have wandered into them. The next nearest place in terms of energy required to get there and back, strangely, is not the Moon but near-Earth asteroid 1982 DB, then comes near-Earth asteroid 1943 Anteros, then the Moon, then three other asteroids:- 1982 HR, 1982 XB, and 1980 AA. Then we move to other near-Earth asteroids of which about 70 are now known. One of these in particular, Eros, has been estimated to consist of a million million tons of iron, a hundred thousand million tonnes of nickel, 56 thousand million tons of chromium, twenty million tons of platinum, with silicon, aluminium, calcium, and possibly cobalt, copper and gold as well. Unfortunately Eros only passes close to us once in every 37½ years, and it last did so when it was studied in the 1970s. Still, this does give us some idea of what the so-called 'rock' asteroids may be like in general.

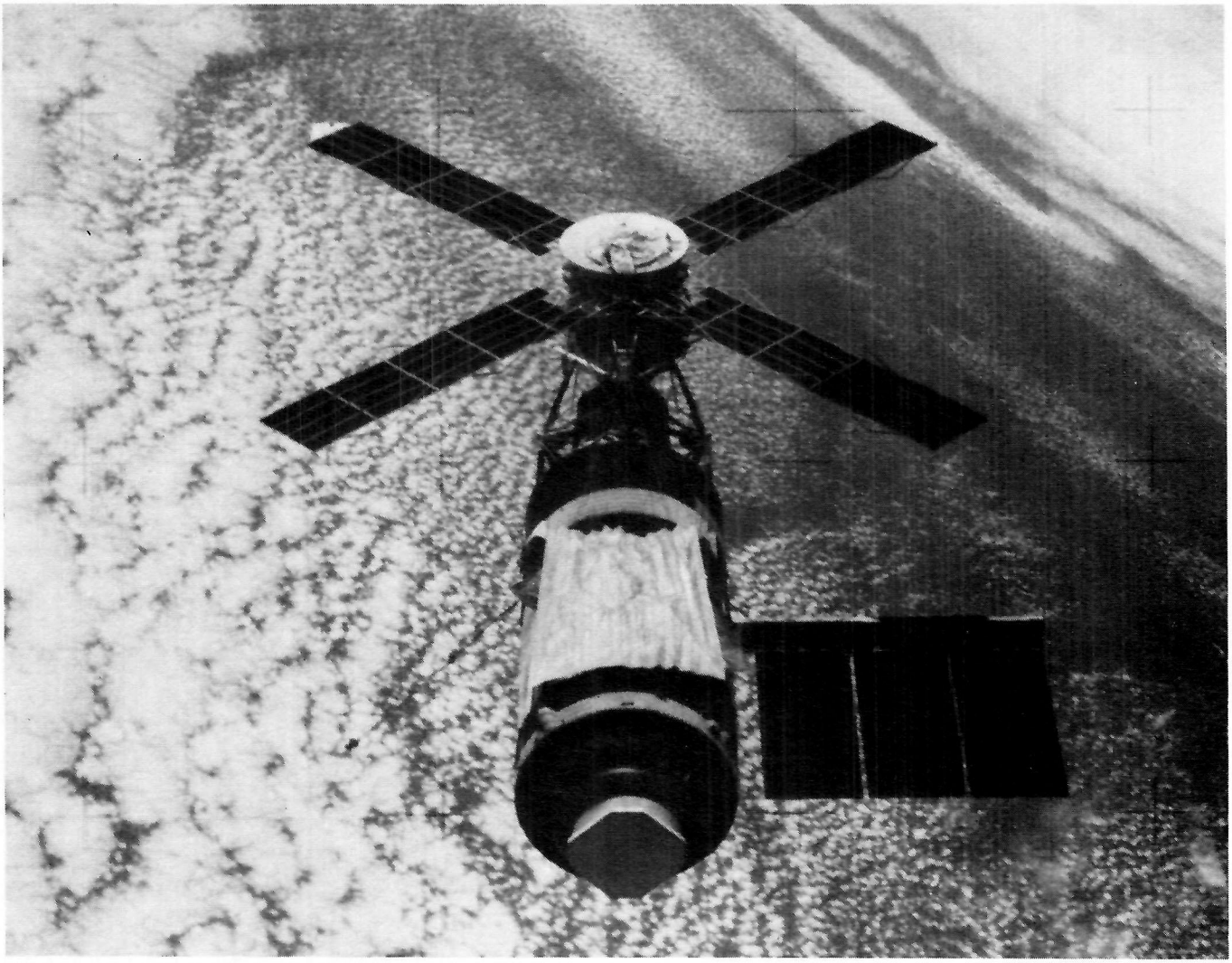
Asteroids come in many shapes and sizes: balls, bricks, carrots, even dumbells, from small rocks up to giants 500 miles across. They are generally one of three main types, rocky, carbonaceous, or metallic. About 60% of those on the main asteroid belt out beyond Mars seem to be carbonaceous, but the near-Earthers seem to be mainly rocky and metallic asteroids. Only three, possibly five, appear to be carbonaceous. These are Ra-Shalom, discovered in 1978 and the very first asteroid confirmed to be carbonaceous even though others had been suspected previously, 1979 VA, and 1580 Betulia. The two possibles are 887 Alinda and 1981 QA. Carbonaceous asteroids appear to be made mainly of carbon compounds, water, nitrogen, and silicon, but with a fair quantity of minerals as well. Of those mentioned, Betulia has a highly inclined orbit, leaving Ra-Shalam and 1979 VA, as the most interesting near-Earthers, easy to get to.

Ball bearings in space

Metallic asteroids such as near-Earther Amor are literally solid metal. Amor seems to be a sort of giant ball-bearing, made of ready-smelted steel, stronger than any made on Earth by man, just waiting for someone to come along, cut it up and cart it off. There is a lot of it though, so this would take several years of hard work, and what are the astronaut miners going to eat in the meantime? This is also one of the problems with the rocky asteroids, many of which, like Eros, would have rich veins of worthwhile resources. Until we get food-farms growing food up in space, it'll all have to be taken with every expedition. This is why carbonaceous asteroids are so important. Their materials are those necessary to have for those food-farms. Carbon, nitrogen and water are exactly what is needed. The Space Studies Institute at Princeton, NASA and others have worked out several ways of accomplishing this. The chances are the Moon will provide the initial material for space industrialisation, but food will have to be taken there, and it will be expensive. Things will not really roll until we get to our first carbonaceous asteroid.

The Planetary Society has been looking at likely missions. The spacecraft and asteroid velocities have to be carefully matched, but even so several missions which could fly by more than one asteroid in this way, have already been planned. A rocket mission launched on 24th September 1992 would arrive at 8 Flora on 1st February 1995, at 149 Medusa on 22nd November 1996, at 407 Arachne on 22nd December 1996, 10 Hygeia on 7th April in the year 2000, 338 Budrosa on 26th November 2001, 241 Germania on 30th March 2004, and at 271 Penthesilia on 25th June 2006. En route it would get a gravity boost by swinging round Mars on 5th August 1993, would spend 14 years on the journey, and pass 4 carbonaceous asteroids, one rocky asteroid, one metallic asteroid and one we're not yet sure about.

ESA has found over 200 worthwhile



The vibration suffered by Skylab during its launch in May 1973 was so great that a thermal shield was torn away. It in turn had neatly removed one of the craft's solar panels. Debris from these mishaps lodged in the mechanism that opened the other solar panel, so that it could not be fully extended. Photo: NASA.

asteroid trajectories for an Ariane launch around the year 1990. Round-trip missions, matching velocity with an asteroid and taking short enough time so that humans could go along, are possible to 1982 DB in 11 of the 14 years from 1988 to 2002. For example, Neal Hulkower at the Jet Propulsion Laboratory, California, has worked one out with a departure in January 1991, getting to 1982 DB in August 1992, staying there for 3 months, and arriving back at Earth in February 1995. In energy this is an optimum mission, but it would require a very large vehicle to carry all the food the astronauts would need for all that time, even if they did use the most modern recycling methods wherever possible. With greater energy expenditure, shorter missions would be possible. One has even been calculated which would get there and back in only 124 days, but unfortunately it won't be available until 7th September 2001.

According to NASA calculations, such missions would require around 30 Shuttle-loads of equipment, but even with this, the over-all cost of a manned asteroid mission would be about a sixth of the cost of one of the Apollo Moon Missions. To get space industrialisation under way in such a manner as to fit in with our Spacelab/Spacehab scenario and timescale, what we really need is a faster, cheaper spacecraft to and from the asteroids. There is one possibility, lightsails.

Mylar sails in the sunset

The principles of lightsailing are virtually the same as those necessary for yacht-sailing, except that instead of an atmospheric wind it uses the pressure of light to propel the craft. You need very large sails and to cut down on mass they have to be very thin. However, material suitable for this purpose has already been manufactured. It is an extremely thin form of mylar, about one ten thousandth of an inch thick, and coated with approximately one molecule thick aluminium. Sail of such material will move your craft very slowly at first, but as acceleraton is continuous, velocity will soon build up. Very high velocities indeed, are possible using lightsails. By taking bottles of relevant chemicals up, very good lightsails could be manufactured either on a Eureca mission or on Spacehab. Round-trip trajectories to the asteroids would need to be worked out for such vehicles, but it has already been calculated that with a lightsail you could get to Mars in three months, as opposed to around three years for a chemical rocket, so there is very good chance that such velocities would provide the answer.

Ion rockets are usually considered to be the best choice for flights to the asteroids. Despite their economy they would suffer from similar draw-backs to chemical rockets. The World Space Foundation wants to test a lightsail in 1986. Everything possible ought to be done to ensure that no obstacles are placed in their way. Further, the 'Union pour la Promotion de la Propulsion Photonique' of France, wants to hold a race of lightsails to the moon around the same time. They too should be encouraged as much as possible.

Bringing back a sample of anything like the 20 million tons of platinium on Eros, from any more accessible asteroid, would arouse a great cupidity among most terrestrial nations. Lightsails use no costly fuel, cost nothing to run except the crew's rations and pay. Lightsails therefore, can make space resource retrieval cheap! The materials are up there already, and they can be brought to space factories economically. Any nation which has the technology to become involved, but hesitates to do so, is throwing away its children's future. A lead on Earth today in microcomputers or biotechnology could be wiped out in the near future by someone mass-producing macrochip controlled robots or new

strains of vaccines on a space station. West Germany is close behind Britain now in both these fields. The West Germans built Spacelab. They have about 20 experiments on it to our half dozen. Full power to their elbows, but don't you think we should be doing more? None of our experiments are in the mainstream of space industrialisation. UK computer manufacturers seem to think space stops at space invaders!

The type of macrochip I've discussed will no doubt be very difficult to grow. It will require extensive testing to perfect, but as soon as it is perfected it will be the basis of what mathematician I J Good, calls a 'UIM', or ultra-intelligent machine. Once put in a mobile computer framework such as a walking robot, and given artificial senses, it will be able to self-program its data-intake, just like we can. It will be able to use a library or computer information network to obtain the knowledge it needs to tackle whatever problems we set it. You would be able to ask it almost anything. If the necessary data wasn't available, it wouldn't be able to answer a problem any more than we could in such circumstances, but there will be many intances where this is not the case. Such a machine, let alone a whole bunch of them will enable the nation which first makes them to streak ahead in almost every science you can thing of, not just in computer science.

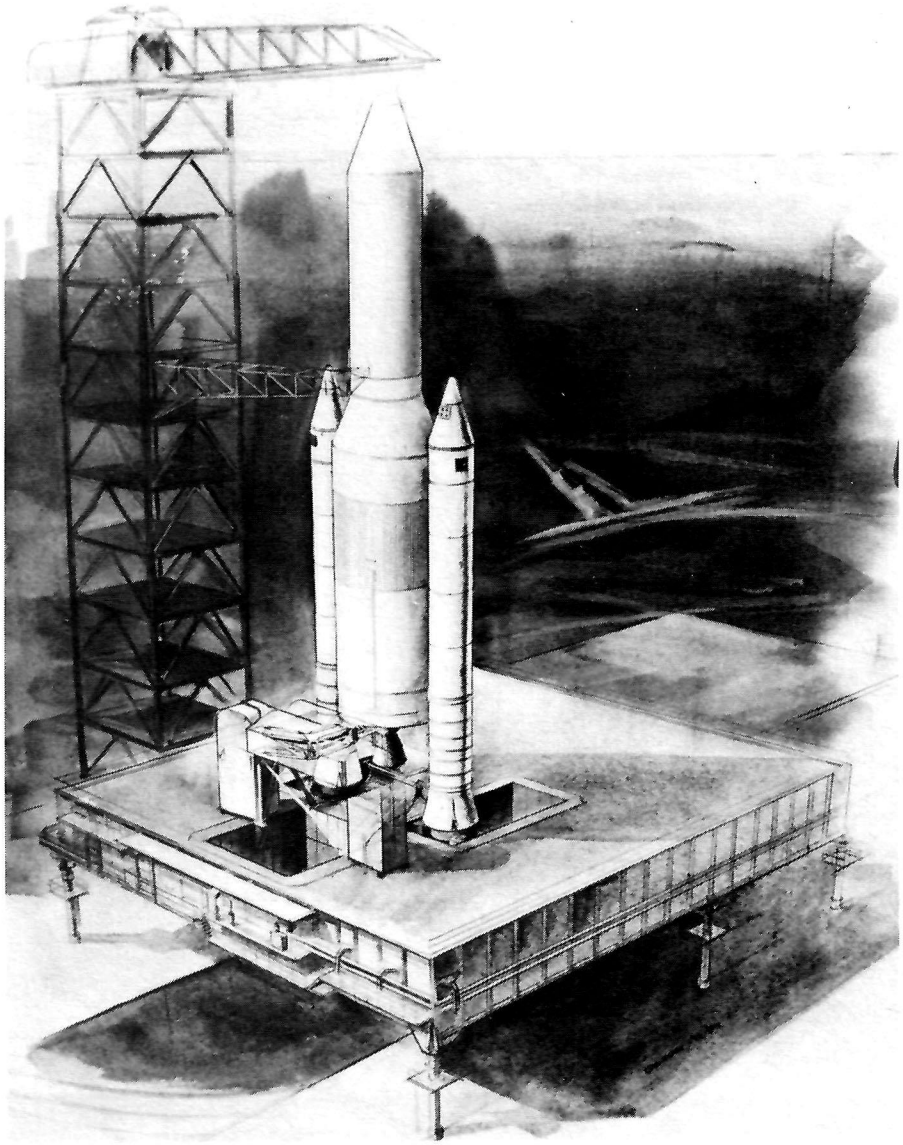
Dr Ulf Merbold, ESA's first spaceman, the European payload specialist on Spacelab One, is a physicist who just happens to specialise in crystal lattices, which of course is an essential science in the production of the required type of macrochip! The West Germans have even booked more or less a whole Spacelab flight for their own use. Called, 'The German Spacelab D-1 Mission', it is scheduled to be launched in June 1985. Dr Heinz Riesenhuber, West German Federal Minister of Research and Technology, says, 'We are promoting materials research under zero-gravity physical conditions such as those prevailing in space, since we hope to acquire basic findings for improving materials ranging from simple machinery materials to highly complicated materials used in micro-electronics. Those who investigate materials in space will be able to produce better products on Earth, which often means a decisive advantage in competitiveness in the market.'

UK lagging behind?

In Britain, communications satellites are our bag, and we do it very well, but this is merely a part of the infrastructure of the space industrial era. Unless we pull up our socks, we will be left behind. Many British scientists and engineers would support a greater UK space effort, and there are probably around a hundred thousand young people at schools and universities who'd give their right arms to get into space. But where is the required leadership from our politicians and industrialists?

Politicians won't act unless they feel the people would back their action, and industrialists won't act unless they believe shareholders would support what they are doing. Neither will therefore do anything about this until the British people as a whole want more involvement in spaceflight! Unfortunately most British people still think spaceflight is a waste of money. Few have read the Chase Econometrics report on the economic impacts of space, which came out in the late seventies, and which showed that for every space job here on Earth, 8 other jobs were created. Space has one of the biggest multipliers known, and is one of the most employment intensive industries known to man. There is a great deal anyone can do, if they really want to change this situation. MPs get lots of letters every day, all on different subjects, and most of them pretty boring. If an MP gets four or more letters on the same subject he thinks an earthquake has hit him. Write to your MP therefore, and ask him if he attends the meetings of the 'All Party Committee on Space', and if not why not? – The All Party Committee on Space is a House of Commons committee which supports British space effort. If all the readers of this magazine were to do this many MPs would sit up and take notice. Write to either David Atkinson MP (Con, Bournemouth East), or George Robertson MP (Lab, Hamilton), and tell them you support their work. They are the joint Chairmen of the All Party Committee on Space. All MPs can be contacted at The House of Commons, Westminster, London, SW1A 0AA. The more you who support space encourage it to happen, the more chance there is that it will. MPs have to know that they've got voter support.

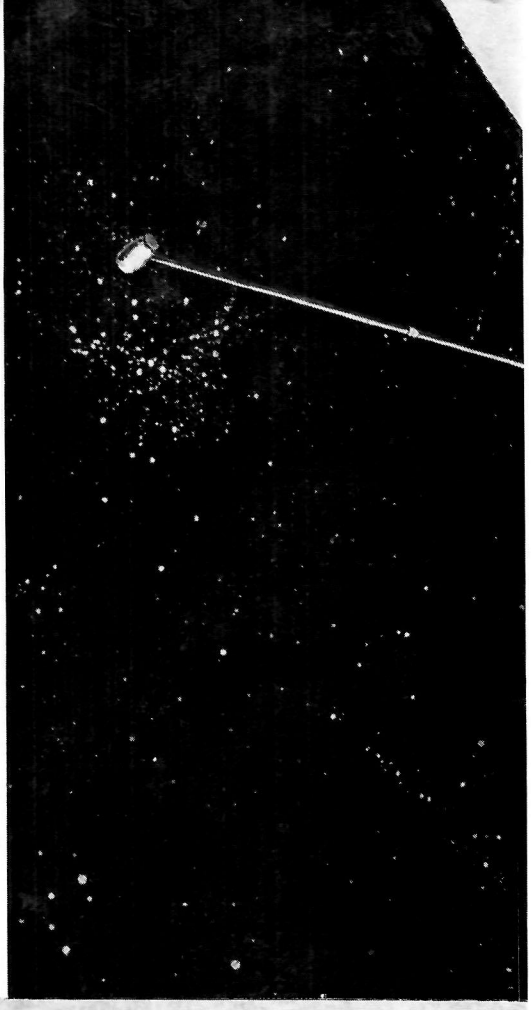
Write to your newspaper, or radio or TV channel, and complain about insufficient coverage of the latest space event, and do so not once, but every time they try to push the Spacelab launch or whatever, into a small paragraph on the second last page. Whatever you do, if you really want to help get Britain more involved in space, join a space society! Most universities have these now, and there are at least three national societies, the British Interplanetary Society, the Association in Scotland to Research into Astronautics (ASTRA), and the space activists who work with the All Party Committee on Space, the Free Space & Space Settlers' Society. Get your friends to write and join up as well!

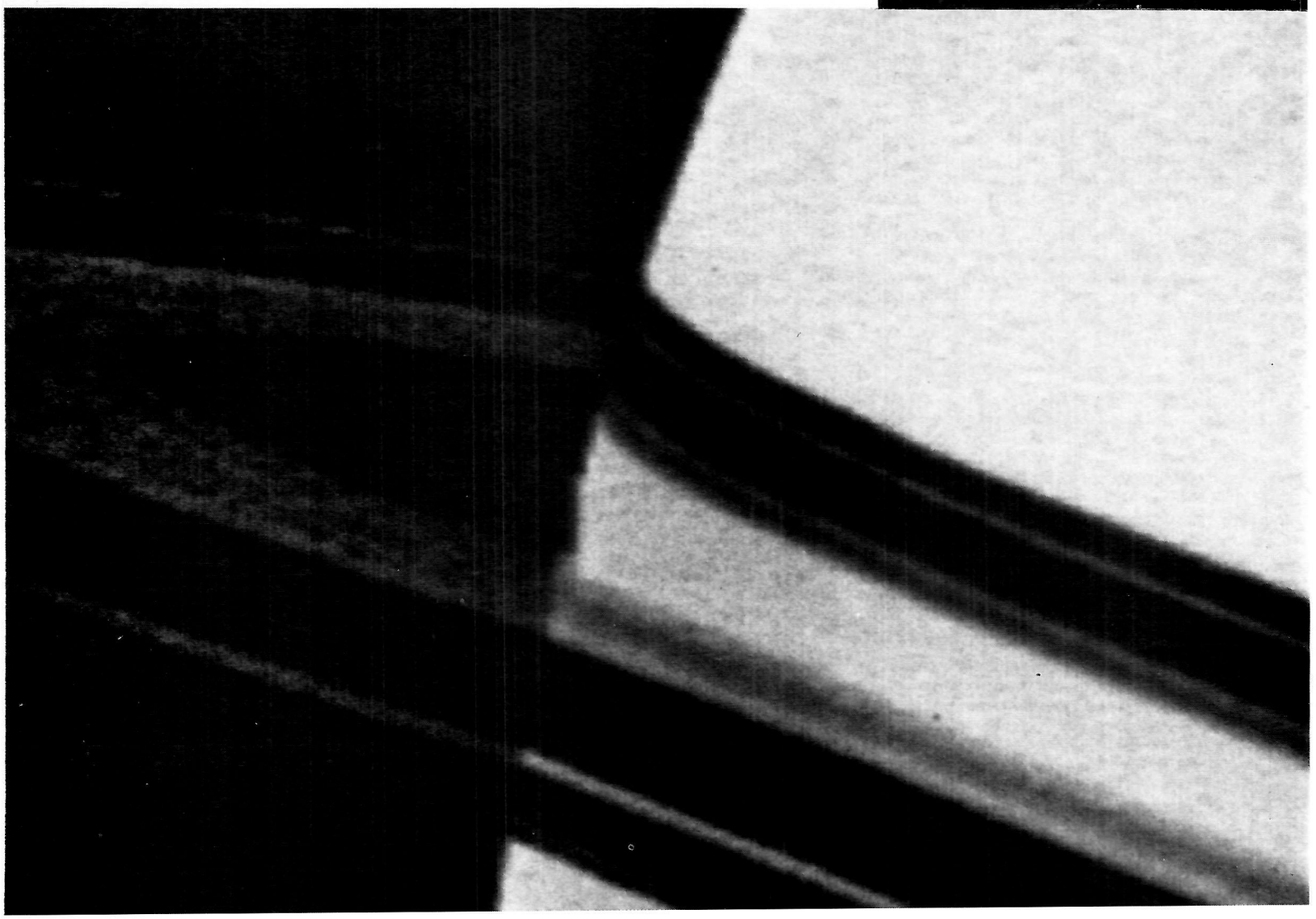


This artist's impression shows a basic design concept for the Shuttle-Derived Cargo Launch Vehicle. It consists of a shortened Space Shuttle external tank in the centre of the photo. A single Space Shuttle main engine is mounted below the tank and two shortened Space Shuttle solid rocket boosters are mounted on each side. A large cannister containing the upper stage and payloads sits above the launch vehicle. The vehicle concept is being studied by Boeing Aerospace under contract to the Marshall Space Flight Centre. Photo: Boeing.

PIONEER SATURN

KAREN KLINGER, SCIENCE CORRESPONDENT OF THE SAN JOSE MERCURY, CASTS A NOSTALGIC GLANCE BACK AT THE FARTHEST FLUNG PIONEER AND THE FRIENDS IT LEFT BEHIND AT JPL.





Far Left: This photograph shows the previously known Cassini division, dividing the outer A ring from the middle B ring. It also shows the French division (predicted by astonomers and confirmed by Pioneer), dividing the middle B ring from the inner C ring. In addition, the Encke division, which splits the A ring, can also be seen at the bottom of the picture. Photo NASA. Left: An artist's impression of the Pioneer 10 spacecraft.

It was a sweet and sad occasion at the end of February 1980 when the National Aeronautics and Space Administration (NASA) held a reception for the men and women who worked with the highly successful series of Pioneer spacecraft. After 16 years, the Pioneer Project Office at NASA's Ames Research Center, 35 miles south of San Francisco, was closing. There would be no more Pioneers. The management of all future US Deep space probes had been transferred to the Jet Propulsion Laboratory near Los Angeles. One by one, the members of the Pioneer team at Ames received their awards. NASA's distinguished service medal was given to Charles Hall, a white-haired scientist who looks like an Irish leprechaun and served as the project manager for the Pioneer explorations of Venus and Saturn.

There are still seven Pioneers working in space and until their power sources give out or their signals become too weak for Earth reception, they will be operated from the Space Missions division at Ames. Four Pioneers form a network of weather stations around the Sun, two are headed out of the solar system and one is orbiting Venus, but their work is mostly done now. They are remnants of an armada which sailed through the vast reaches of the Sun's planetary system. Those who developed the Pioneer series may have saved the best for last: in December, 1978, the Ames team shot four probes into the atmosphere of Venus in a kamikaze mission which yielded a great deal of information about the cloud-shrouded planet that is Earth's nearest neighbour. Then, on September 1, 1979, Pioneer 11 made history by flying past the rings of Saturn and sending back reams of data about the solar system's second largest planet.

Pioneer 11, renamed Pioneer Saturn, blasted off from Cape Canaveral, Florida, aboard an Atlas-Centaur rocket on April 5, 1973. During the course of its long journey to Saturn, scientists and technicians at Ames began referring to it as a 'sturdy soldier' and an 'old friend'. The spacecraft looks something like a giant saucer with legs, weighing 258 Kg, including a 30.4 Kg payload of 14 experiments. Because of the great distances it had to travel from the Sun, Pioneer's designers deemed solar power impractical. They equipped it instead with four Radioisotope Thermal Generators (RTGs). The generators contain radioactive plutonium. As the plutonium decays, it emits enough heat to produce 108 watts of electricity, used to power the radio and experiments.

Pioneer Saturn was not without problems. Shortly after launch, the rods for the RTGs failed to slip into place properly. Technicians had to send radio commands that moved the saucer around until the rods were properly positioned. A month later, one of the two radio transmitters aboard the craft died. The backup transmitter took over and has worked well ever since.

In addition, Pioneer's asteroid-meteorite detector failed and the spacecraft encountered problems with its de-spin thruster. Consequently, it spins faster than anticipated as it moves through space. During its lengthy trip to Saturn, the ship courted danger more than once as it threaded through the solar system's asteroid belt and flew head-on into the intense radiation surrounding Jupiter. It flew past Jupiter in December, 1974, using the planet's immense gravitational field like a slingshot to hurl it along to Saturn.

Planetary understudy

Pioneer 11 was never designed for a flight to Saturn. It was launched as an understudy to a twin probe, Pioneer 10, for a Jupiter fly-by. When both Pioneers survived their Jupiter flights with no great damage, NASA put together an ad lib plan to send Pioneer 11 to Saturn as a trail blazer for Voyager 1 and 2. The Voyagers were more sophisticated than Pioneer and had exceptionally good cameras. The camera aboard Pioneer, which sent back some striking pictures of Saturn's rings, was only one of a number of vital instruments. Another was the infrared radiometer, which measured how much heat Saturn radiated. The measurement helped to determine the composition and temperature of the planet's atmosphere.

Other important devices were the cosmic ray telescope, which studied the composition of the cosmic rays that permeate the solar system and the plasma analyser, which recorded the solar wind, providing information about the stream of particles constantly flowing from the Sun. Among the tasks of the instrument payload:- determining the number and composition of the rings, which looked like 'cup handles' to Galileo in 1610; looking for new Saturnian moons; and analysing the make-up of a planet whose volume is 815 times greater than that of Earth's, but whose mass is only 95 times that of our own planet.

As the spacecraft moved into the home stretch of its three-billion kilometer journey in July 1979, a storm on the Sun increased the solar wind. Then, in the middle of August, a solar flare boosted the Sun's magnetic output. The resultant increases in electricity and magnetism interfered with Pioneer's radio signals. One disconcerted scientists said it was as if the spacecraft's instruments had had a shutter pulled over them. The force of the solar wind also wreaked havoc with the spacecraft's attempt to find the bow shock at the edge of Saturn's magnetic field.

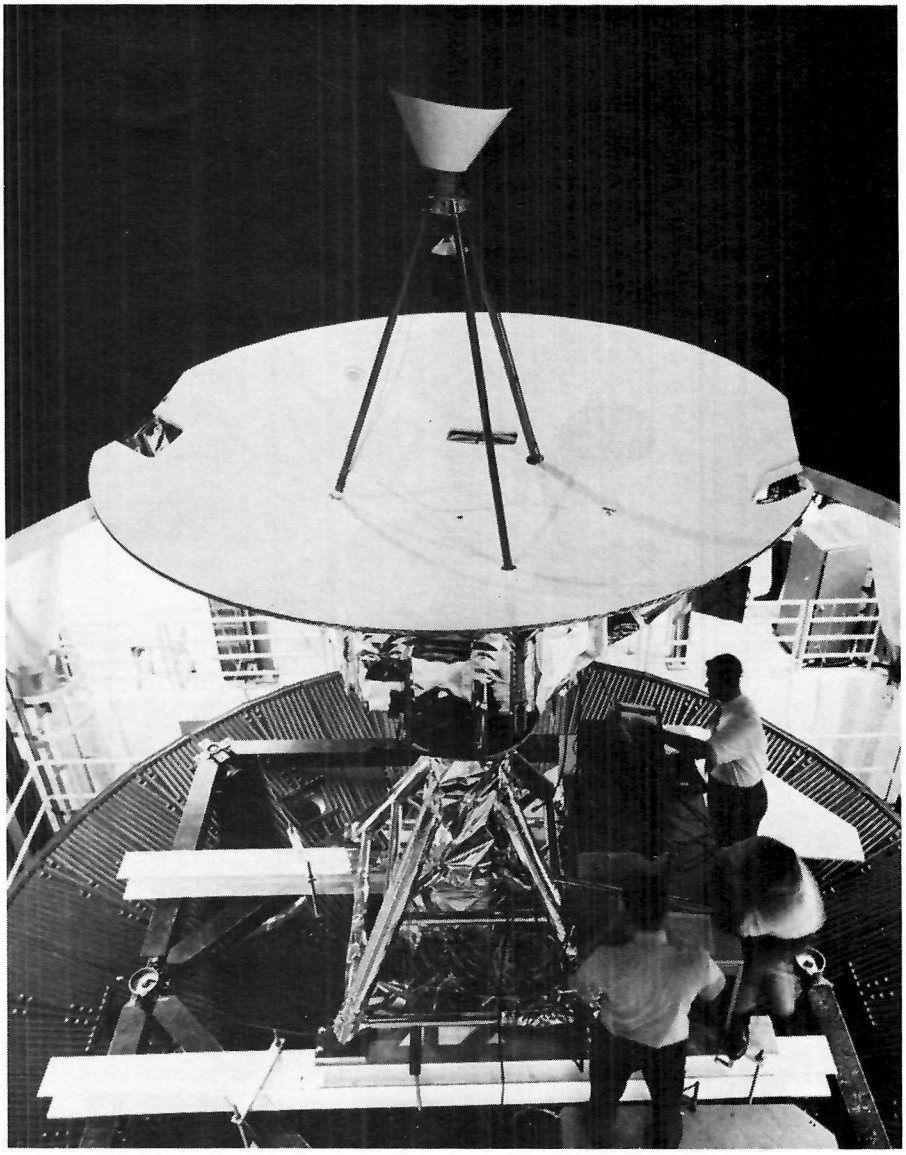
Before Pioneer 11 reached Saturn, scientists weren't sure if the planet had a magnetic envelope, as Jupiter and Earth do. If it did, then

the first sign would be the bow shock crossing at the point where the magnetic field holds off the solar wind. As the spacecraft got closer to Saturn, still with no sign of the bow shock, the scientists at Ames waited and wondered. 'The Sun and the interplanetary medium are being extremely unco-operative,' chief project scientist John Wolfe joked at one point. On August 31, the day before close encounter, Pioneer finally found the boundary of the transparent magnetic field at a distance of 1 446 00 kms from the planet. The solar wind had been compressing the field, pushing it back toward Saturn. The same day, the robot space traveller zipped to the outermost Saturnian moon, Iapetus, which has puzzled astronomers because it is siz times brighter on one size than the other. Some of the assembled scientists speculated that Iapetus may be an icy moon with dark dust on it, or a dark moon with snow on one side, but they agreed that Pioneer was not equipped to solve its mystery.

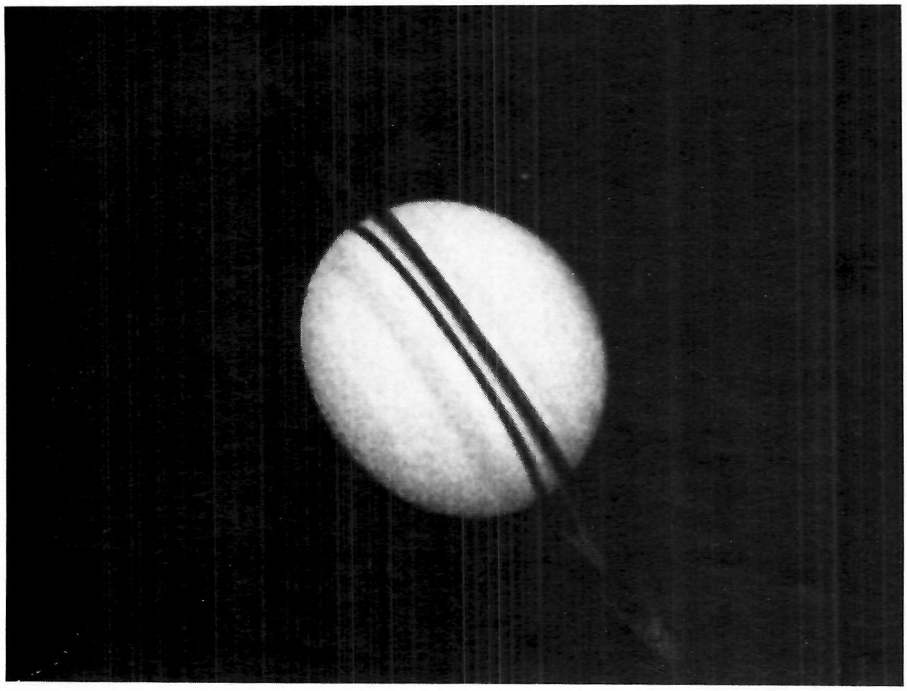
The force of Saturn's gravitational field accelerated the spacecraft's speed as it approached the planet until it achieved a top speed on encounter day of 114 500 kms per hour (72 140 mph). As it moved towards Saturn, Pioneer's vantage point above the rings gave its camera a chance to take pictures that looked like negatives of the familiar photographs taken with Earth-based telescopes. While previous pictures had always shown the rings brilliantly lit by the sun when they tilt toward Earth, the view from Pioneer was comparable to that seen when a printed fabric is held up to the light. Because the camera could record features only by virtue of light leaking through the thin disk of rings from the underside, the regions where the rings are most tenuous appeared brightest in the photographs, while the densest parts looked darkest.

Long before the era of spacecraft, astronomers knew there were at least three rings circling Saturn. They were called the outer, middle and 'crepe' rings, also named the A, B and C rings in order. Measuring to the cloud tops of the 120 000 kms-wide planet, the dimensions of these rings are: outer ring, 76 200 to 61 800 kms to Saturn; middle ring, 57 600 to 31 800 kms crepe ring, 30 000 to 13 200 kms.

Pioneer's measurements confirmed the existence of a 4200 kms gap of thin material called the Cassini division separating the outer and middle rings and a 1800 kms French division between the middle and crepe rings. They also found a previously undiscovered,



Below: This picture was taken by Pioneer Saturn from a distance of 2,500,000 kms. It has undergone extensive computer processing to pick out fine details on the planet's surface and in the ring system. The picture was made by an on-board imaging photopolarimeter. This measured the red and blue components of sunlight scattered by Saturn and its rings and converted them into numbers which were radioed to Earth. Photo NASA.



Above: The Pioneer 11 spacecraft is just about to be loaded into a thermal vacuum chamber for testing at TRW's Space Systems Division in California. The dish focused the craft's 8 watt radio transmissions on the Earth almost one billion miles away. The craft weighed 570 lbs at launch. Photo NASA.

very narrow band called the 'F ring' girdling Saturn outside the A ring at a maximum distance of 79 800 kms from the planet's clouds. In between the A and F rings is a gap now called the 'Pioneer division.' The spacecraft did not find evidence of an expected innermost D ring or an E ring thought to lie outside the A band. It did come up with data indicating that a wispy sheet of material, apparently an extension of the rings, oribts Saturn beyond the F ring.

Iced rings

Data from Pioneer's ultraviolet photometer indicates that the rings are mainly ice, encircled by a cloud of atomic hydrogen. On their sunlit side, they have an average temperature of −343 degrees Fahrenheit. Still unknown is whether the rings are remnants of moons broken up by Saturn's gravity or whether they may be primordial space debris located too close to the planet to clump into moons.

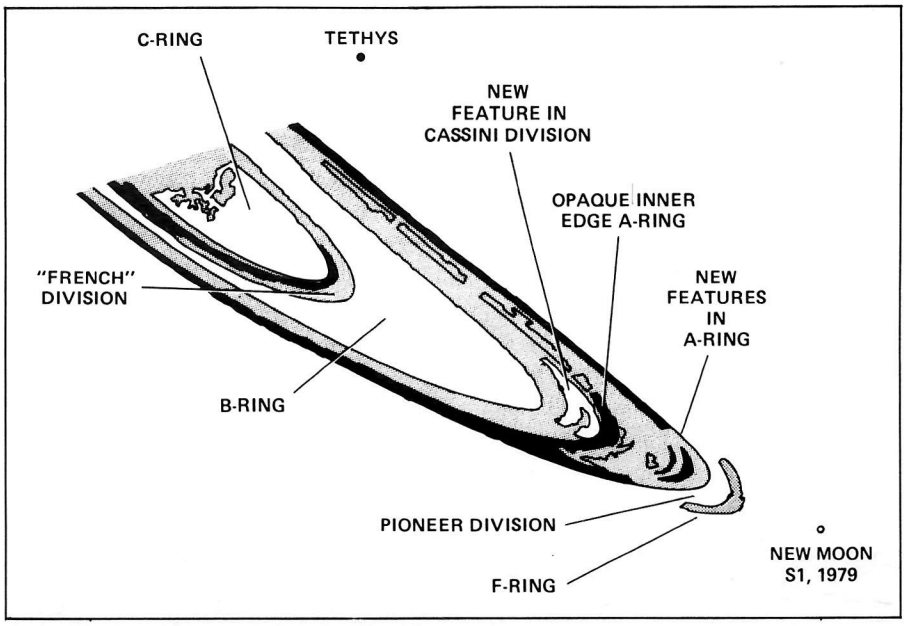
The pictures beamed back by the spacecraft showed the yellowish face of Saturn to be capped by a slightly darker and bluer polar region. In the north temperate belt there were at least ten subtle bands of colour and the equatorial zone was strikingly bright. In general, the Saturnian markings were far less conspicuous than those of Jupiter, which has a similar gaseous composition consisting largely of hydrogen and helm. The relatively bland face that Saturn presented was no surprise to scientists, although several called it 'disappointing.' With an atmospheric temperature of 290 degrees below zero Fahrenheit, Saturn is more sluggish than Jupiter and less prone to have the violently complex waves and eddies prominent in Jupiter's upper clouds.

Temperature measurements and gravity field analysis suggested that Saturn has an iron and rock core about twice the size of the Earth, but so compressed that it has 11 Earth masses of material. Out from the core to about 21 000 kms the planet consists of liquid metallic hydrogen, which does not exist on Earth. It is believed that the hydrogen acts as a liquid electrical conductor for Saturn's magnetic field.

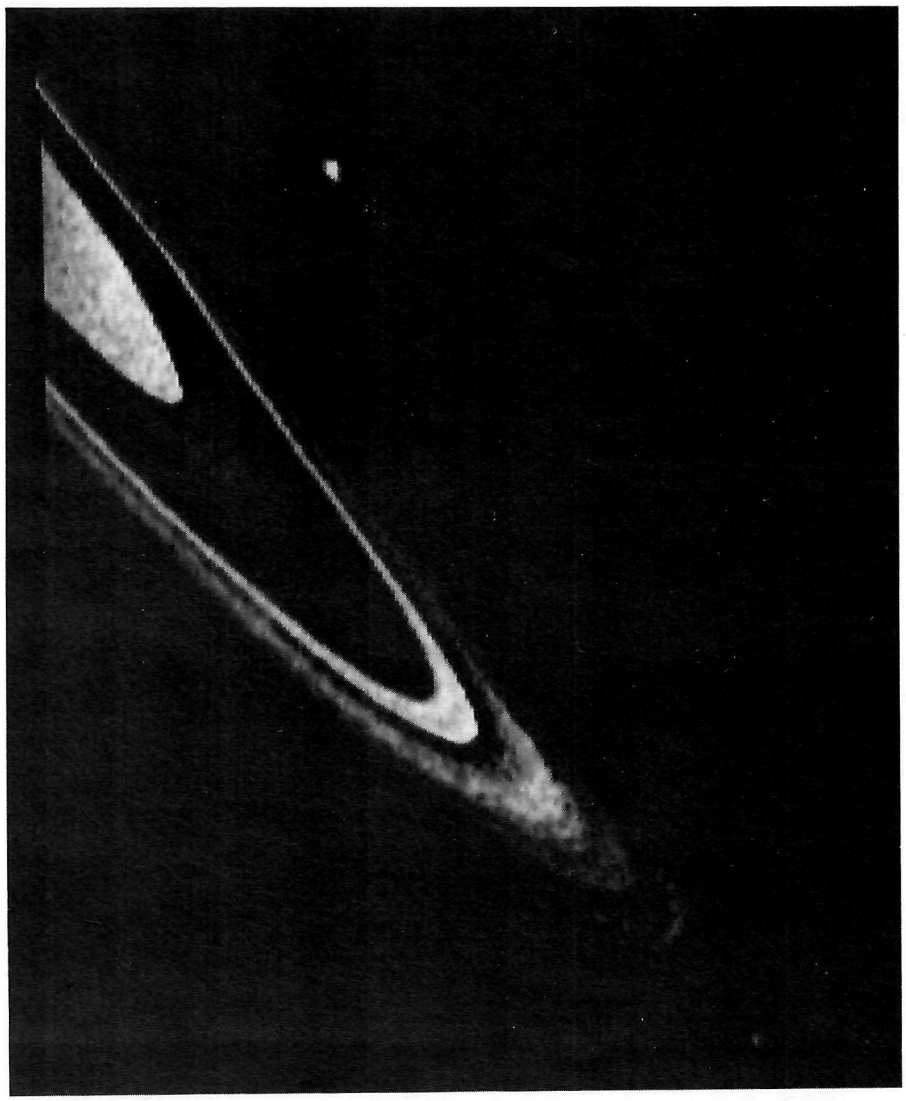
Saturn's upper atmosphere is about 41 degrees Fahrenheit warmer than expected and it appears that the planet radiates two and a half times more heat into space than it absorbs from the Sun. Scientists speculated that most of the heat is generated by helium sinking through the liquid hydrogen interior.

Life or death flight

On the morning of closest approach, when Pioneer would swoop through the outer rings to within about 20 800 kms of the Saturnian clouds, the control room at Ames filled with tension. Some people, like project scientist John Wolfe, predicted that the chances for the spacecraft's survival were no better than 50/50. Technicians watched their instruments, waiting the 86 minutes it took Pioneer's signals, travelling at the speed of light, to reach Earth. When it became clear that the spacecraft had safely blazed a trail through the ring system, the mission control centre erupted with joy. 'We might have been lucky,' Charles Hall said, 'but then, we've been lucky all along.' Thomas Young, then deputy director of Ames and now director of NASA's Goddard Space Flight Centre in Maryland, was ebullient. 'We



Beyond the outer tip of the A ring (the outer visible ring) the thin band of the F ring discovered by Pioneer 11 can be seen. Beyond this is Saturn's 11th moon called S-1 1979, also discovered by Pioneer 11. Photo NASA.



can report to Voyager 2, the way is clear, come on through. The rings are great,' he said. Voyager 2, which reached Saturn in August of 1981, took roughly the same path through the rings as Pioneer 11. After its Saturn fly-by, Voyager 2 was tentatively scheduled to go on to Uranus.

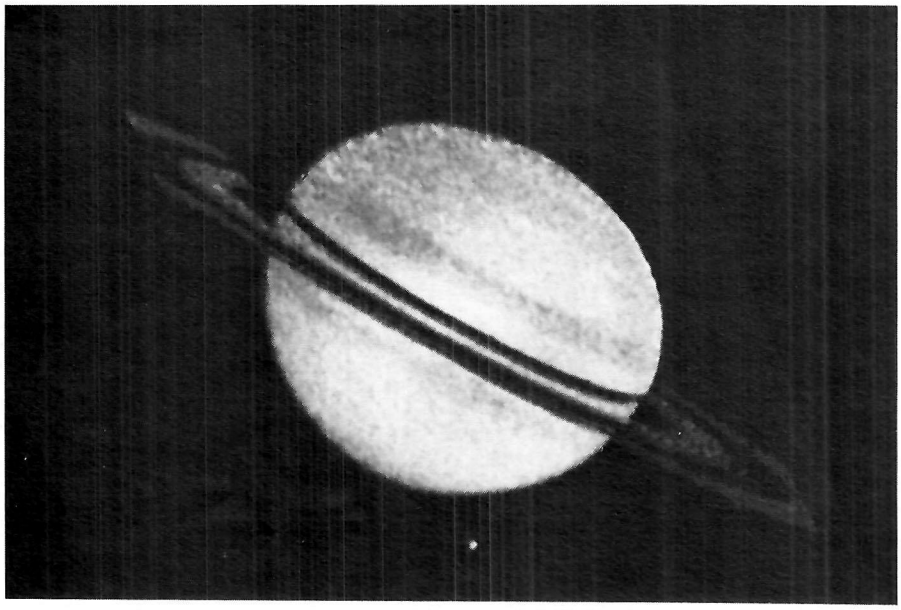
In all, it took Pioneer four hours to cross the underside of the ring system. Meteorite detectors attached to the spacecraft's radio antenna were penetrated twice, but the total number of collisions may have been far more because the instruments could measure only two hits in each one hour 20 minute period.

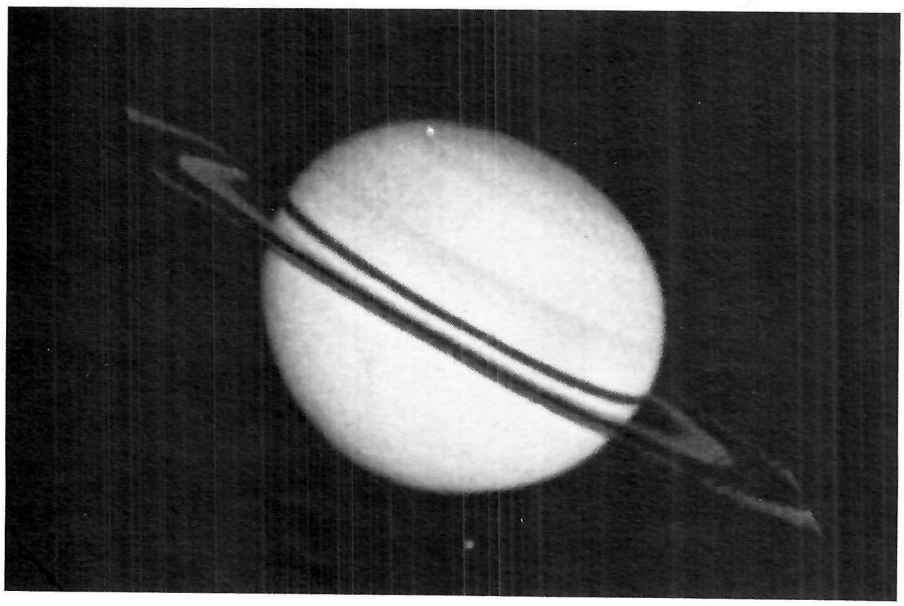
For 78 minutes, the probe was behind Saturn and out of touch with the Earth. During its passage, Pioneer found that Saturn's rings absorb high-energy electrons and protons which whip back and forth along magnetic lines connecting the planet's north and south poles. Dr James Van Allen of the University of Iowa called the ability of the rings to cut off the flow of charged particles a 'guillotine effect'. Van Allen was the first to identify the Earth's magnetically-held radiation belts which now bear his name.

In a picture taken the day before closest approach, Pioneer 11's camera recorded a spot of light which subsequently was identified as a newly-found Saturnian moon, the eleventh discovered. Because of its small size (its diameter is estimated to be between 200 and 400 kms) the moon was informally dubbed the 'Pioneer rock'. Officially, it has been named 1979 S1, as the first satellite of Saturn discovered in 1979. Scientists say S1 may be the same body as the 'ghost moon' S11 which has been observed from Earth, but whose existence had been in doubt.

S1 has about the same diameter as Janus, the smallest previously known moon of Saturn. It is located about 14 800 kms from the edge of the A ring, inside the orbit of the moon Mimas. The new-found moon appears to circle Saturn in a 17 hour orbit.

Several months after the Saturn fly-by, Dr Van Allen said analysis of particle beam data showed that Saturn may have two additional moons, designated S5 and S3. However, these were not found by Pioneer's camera and a NASA report said their visual confirmation would have to await Voyager 1's arrival in November. Pioneer 11's outward passage from Saturn took it past the moons Enceladus, Mimas, Dione, Rhea and finally the planet-sized Titan, 5800 kilometers in diameter. For sheer size, no moon in the solar system rivals Titan except Triton, which orbits Neptune and is too distant to be seen clearly. Interest was high in Titan and its atmosphere of reddish-brown haze because scientists had theorised that the moon might harbour amino acids, the building blocks of life. If the haze could trap enough heat, the theory went, large organic molecules might be formed through the linking of gases like methane and nitrogen. Polymers could be formed and, perhaps, amino acids.





These two images show how computer processing can enhance the received image. Saturn's moon Rhea appears as a speck of light below the planet. The distorted shape of the planet is a result of the way the image was recorded – it is corrected at a later stage by further processing. Photo NASA.

Clash of the Titans

Although Pioneer 11 only took a quick look at Titan, its measurements indicated that the atmosphere is much too cold to support any form of life today. Titan's cloud top temperature was estimated to be 324 degrees below zero Fahrenheit. This would indicate that the moon has no internal heat source, but it leaves open the possibility of a 'greenhouse effect' in which the haze amplifies the heat supplied by the sun.

Titan was found to have a magnetic wake within Saturn's magnetosphere and a methane atmosphere which is slowly breaking down into hydrogen and carbon, with the hydrogen escaping into space. Pioneer 11 and its twin, Pioneer 10, were built as part of a 110 million dollar project that has been regarded as one of the best bargains of the American space exploration program. Voyagers 1 and 2, built several years later, cost four times as much.

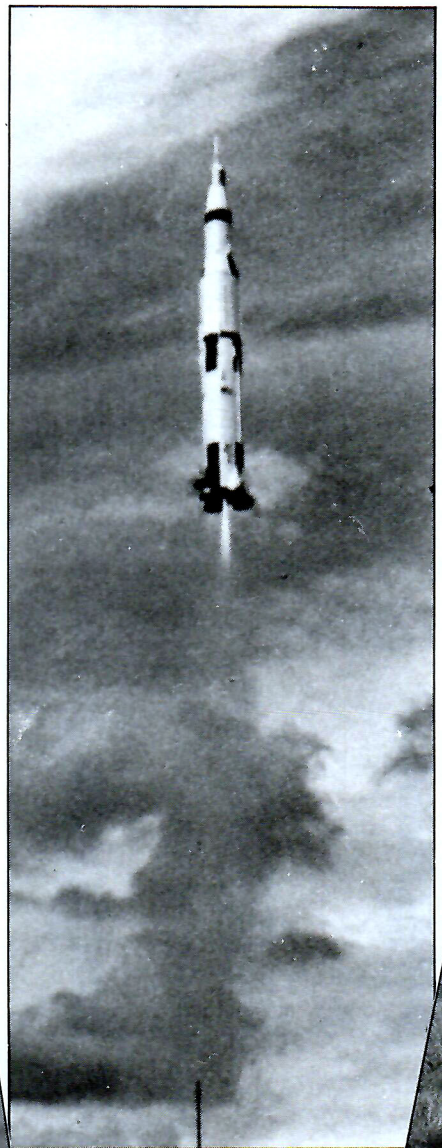
For NASA, the coming decade of deep space exploration will not match the past 10 years. Financially strapped by the burgeoning costs of the reusable space shuttle, the agency has won Congressional approval for only one new interplanetary mission in the 1980's, the Galileo probe of Jupiter. With its mission accomplished, Pioneer 11 moved toward the outskirts of the solar system. It will cross the orbit of the planet Pluto before the end of the century and eventually will wander endlessly among the stars. In July 1979, Pioneer 10 cut through the orbital plane of Uranus and is heading in the general direction of the red star Aldebaran. On June 13, 1983, Pioneer 10 crossed the orbit of the farthest plant from the Sun (Neptune) and became the first spacecraft to leave the Solar System.

The two spacecraft are moving in nearly opposite directions, one going through the 'head' of interstellar gas clouds and the other exiting the tail. Both ships carry on their frames a 6 by 9 inch gold anodised plaque containing the symbols of the hydrogen atom, pulsars, the solar system and drawings of a man and woman. The plaques are, in effect, universal greeting cards, offering salutations to any intelligent beings who might intercept the spacecraft.

MODEL ROCKETRY

Peter Freebrey launches into part 1 of his series on pint-sized rockets

For a long time people have had a fascination for rockets. The Chinese have manufactured them for hundreds of years not only for entertainment but also as functional weapons of war. In other parts of the world, rockets developed more slowly but along similar lines with some additional uses such as signal devices and the motive power to get emergency lines to ships in distress, etc. The thought of using the rocket as the motive power for transporting man was a goal that many scientists dreamt of achieving. Added to this was the realisation that whereas the internal combustion engine would only work in the Earth's atmosphere, the rocket engine had no such restrictions... The Moon, planets and outer space were there for the rocket to explore. Back in the sixties the dream became a reality and with the Conquest of Space on our doorstep came an avid desire to understand and be involved with rockets, satellites and anything to do with this new and exciting field. Space Modelling changed, almost overnight from being a risky, experimental slightly crackpot pastime of isolated individuals to the hobby, sport and science that we know today.



K. Urban flying superscale Saturn V on his home ground at European Championships in Czechoslovakia.
Paul Clark, Chairman of the British Spacemodelling Association with one of his many flying scale Ariane 01's.

What is space modelling?

Space modelling also known as Model Rocketry is all about building and flying small, light-weight models using 'rocket power'. These rocket motors are NOT home made but are commercially produced to quite exacting standards. Prior to the regular commercial production of model rocket motors there were literally hundreds of accidents that had been caused by people trying to make their own propellents and motors. In fact in America such people are known as 'basement bombers'! Some model rocket motors are not cheap... BUT they are still infinitely cheaper than the loss of an eye, limb or your life. If you are going to take up this fascinating hobby do NOT be tempted to become a 'basement corpse'!

Now let's look at what goes into the making of a simple space model. This consists of

Photographed by Stuart Lodge, Dick Swan's Saturn V reaches for the sky, only the small exhaust flame tells you it is a model.
A typical launch of a small 'sports' model, note the convenient height of launch pad.

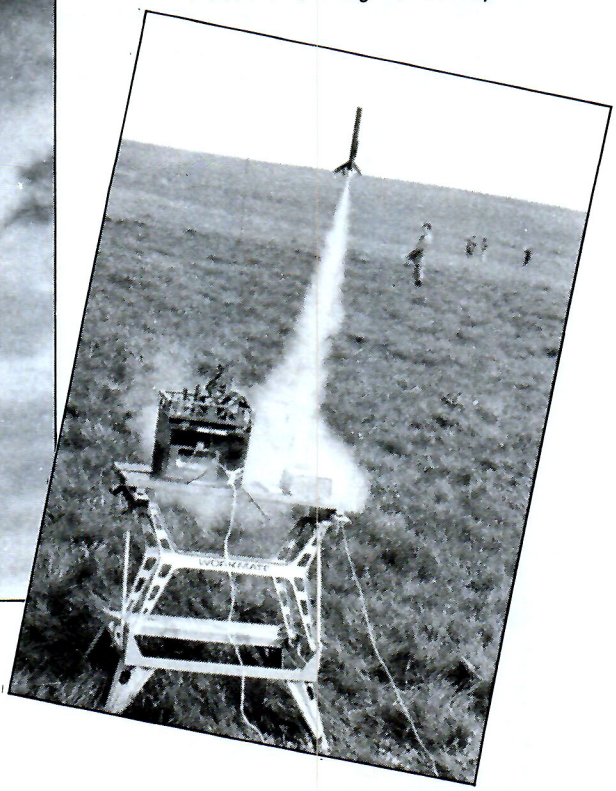
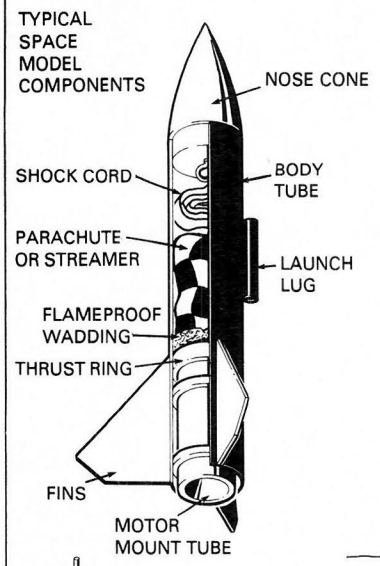


FIG. 1



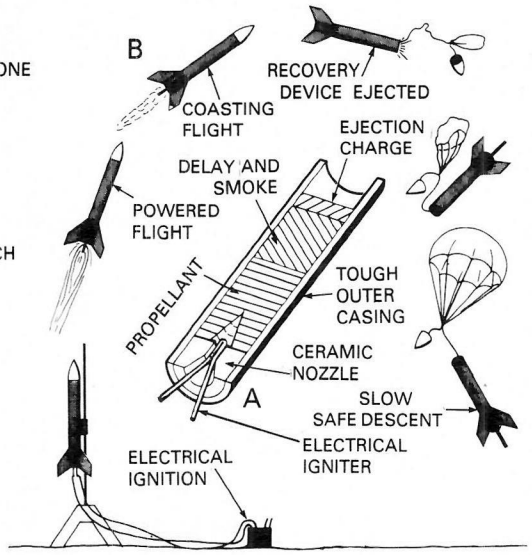


FIG. 2. A, Section through model rocket motor; B, Typical flight pattern.

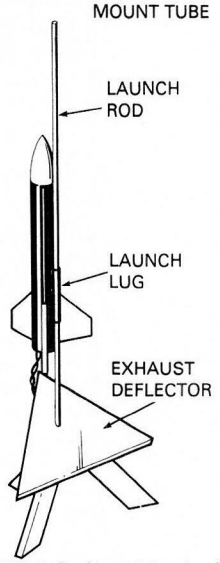


FIG. 3. Basic model rocket launch pad.

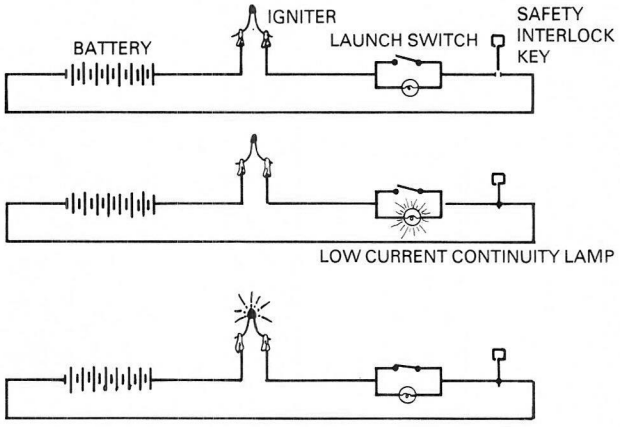


FIG. 4. Sequence of electric ignition.

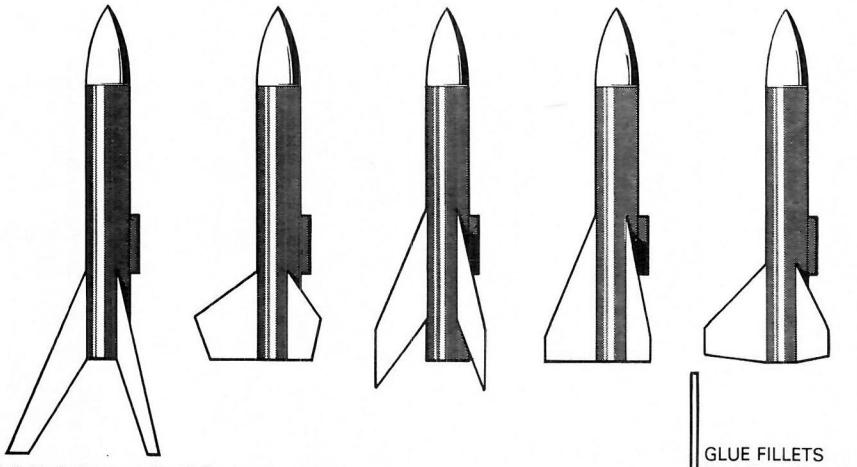
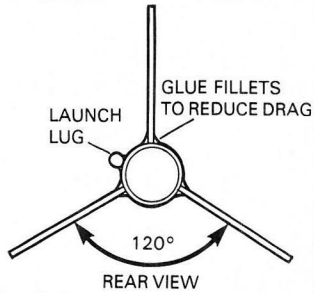


FIG. 5. Variations on simple fin shapes using same rocket body.



basically three parts:

1) the model of the vehicle itself
2) the rocket motor
3) the means by which the model returns to terra firma, safely and in such a condition that we can use it again and again.

Model

For a simple beginner's model the rocket would probably follow the lines of one of those in Figure 1. It would have a straight tube for the main body, a streamlined curved cone for the nose and fins similar to those shown. The body length would be somewhere about ten to fifteen times the body diameter and on a three fin model, each fin would have an area of about three times the body diameter (ie if the body tube diameter = 1 inch then the area of EACH fin = 3 square inches).

Motor

The rocket motors are something we buy rather than make and are used only once. They come in a variety of sizes and are grouped together by their total thrust output. The maximum size is limited by the permitted weight of propellant in the country of use. In practice there are International Rules for Space Modelling and the maximum size that may be obtained has about four ounces of propellant. This is a very big motor, the most common ones used by both sports and competition modellers containing less than half an ounce! The motor has three distinct functions:

a) to produce thrust to propel your model skywards
b) to have a specific time delay to enable the model to coast on upwards after the thrust stops . . . before
c) firing a 'retro' charge which operates a device to bring the model safely back to earth.

The cross section of a typical motor is shown in Figure 2. These are fired, not by the old fashioned Guy Fawkes type blue touch paper but by an electrical igniter. This consists of a short length of NiChrome wire that has a small blob of something like safety match material attached to it. It is inserted through the motor's nozzle so that it is held against the propellant. When an electric current is passed through the wire from a battery, the wire glows the 'match head' burns . . . the propellant ignites . . . we have lift-off. Thrust only lasts for a very short time, for most of the commonly used motors . . . less than two seconds. After this comes the delay burn, this serves two functions. Firstly, it produces smoke so that we can keep track of where the model is going. Secondly, as we can buy similar thrust motors with different delays, we can arrange for the 'retro' (or ejection) charge, to be fired as close to the flight's apogee (highest point before the model descends) as possible. Whereas the propellant charge can only escape through the exhaust nozzle, the 'retro' charge's easiest path is into the body of the rocket! This sudden burst of high pressure is used to activate the recovery device.

Recovery

There are a number of ways in which recovery may be achieved. On a very light model (under half an ounce) it is sufficient to simply blow the nose-cone out of the body tube (it is still attached by a length of strong thread). This

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upsets the stability of our beautiful streamlined rocket and the model tumbles in the air, falling gently to the ground. Although this method is quite safe for the very light-weight model it would obviously be unsatisfactory for anything heavier. The two most common systems are to use either a parachute or a streamer. These are attached to the nose-cone and packed into the top of the body tube. As the 'retro' charge is fairly hot (!), a pad of flame-proof wadding is placed between the motor and the parachute (or streamer), this also acts as a piston, so helping eject the 'chute and nose-cone.

Lift-off

We now have a working space model ready to fly, body, motor and parachute in place. What next? Well . . .we could fire our rocket motor but be prepared to DUCK. A rocket's flight is held stable by its fins. If a rocket has no fins it would career all over the sky and most probably crash. For all you clever-clogs who are muttering about Saturn V, they are steered by rocket engines that can move on gimbals. . . Now back to our model . . . the fins can only act as stabilisers if they are moving through the air and then only if they are travelling fast enough. If we launched our rocket just with it standing on it's fins, the initial thrust of the motor would lift the model off the ground but it's velocity would not be great enough for the fins to have any effect! The model may go any which way but up . . . DUCK!

To solve this problem, we fix a small tube (say 1/8 inch diamter) to the side of the body and then launch our model up a three foot steel rod (Figure 3). 5. . .4. . .3. . .2. . .1 . . . LIFT-OFF . . . the model accelerates up the launch-rod, by the time it leaves the rod, the fins are fully operational and we have a fully stabilised space model streaking for the stars.

Rockets plus

The simple model described above is only the beginning of what you can find in space modelling. There are multi-engined and multi-staged models, scale models of the Space Shuttle, X-Wing Fighters and many more highly futuristic designs. In the pure fun department you will find flying saucers and Snoopy's dog kennel!

Not only can it be great fun just as a hobby but there is also the sporting aspect as well. America and Czechoslovakia were the first countries to have a large model rocketry following but for some time now, they have been joined by Bulgaria, Canada, Poland, Rumania and Spain to mention but a few who regularly hold competitions for many classes of space models.

The Queen of the events is Scale, Class S7. Some of the models seen at the World Championships have to be seen to be believed. The obvious competition for model rockets is

Continued on page 66

Safety code

1. Construction – My model rockets will be made of lightweight materials such as paper, wood, plastic and rubber without any metal as structural parts.

2. Engines – I will use only preloaded factory-made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.

3. Recovery – I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.

4. Weight Limits – My model rocket will weigh no more than 453 grams (16 oz) at lift-off and the engines will contain no more than 113 grams (4 oz) of propellant.

5. Stability – I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.

6. Launching System – The system I use to launch my model rockets must be remotely controlled and electrically operated and will contain a switch that will return to 'off' when released. I will remain at least 15 ft away from any rocket that is being launched.

7. Launch Safety – I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.

8. Flying Conditions – I will not launch my model rockets in high winds, near buildings, power lines, tall trees, low-flying aircraft, or under any conditions that may be dangerous to people or property.

9. Launch Area – My model rockets will always be launched from a cleared area, free of any easy to burn materials and I will use only non-flammable recovery wadding in my rockets.

10. Jet Deflector – My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.

11. Launch Rod – To prevent accidental eye injury, I will always place the launcher so that the end of the rod is above eye level, or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use, I will always store it so that the launch rod is NOT in an upright position.

12. Power Lines – I will never attempt to recover my model rocket from a power line or other dangerous place.

13. Launch Targets and Angle – I will not launch rockets so their flight path will carry them against targets on the ground and will never use an explosive warhead nor payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.

14. Prelaunch Test – When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through prelaunch tests. I will conduct launchings of unproven designs in complete isolation.

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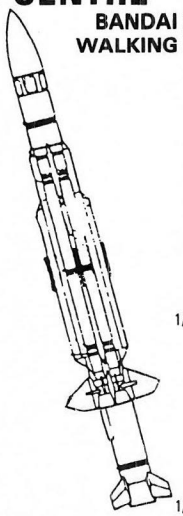

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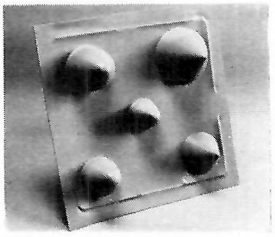

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Star Wars

1. Nine (1)
2. The Imperial Senate (1)
3. Dantooine (1)
4. Owen-Lars (1)
5. The Kessel Run (2)
6. Dia Noga (2)
7. Captain Antilles (3)
8. Red (Colour code for the attack squadron) (3)
9. Five (Luke's code number) (3)
10. The Ambassador (4)

Maximum Star Wars score..... 21 points

The Empire Strikes Back

1. Hoth (1)
2. Tauntaun (1)
3. All Terrain Armoured Transport (1)
4. Dagobah (1)
5. Mining (2)
6. Obiwan Kenobi (2)
7. Yes – it has ears ('You look strong enough to pull the ears off a Gundark' says Han to Luke) (3)
8. 'Echo Base' (Code name for Rebel Headquarters on Hoth) (3)
9. C3PO (3)
10. Two-One-Bee (21B – Medical Droid) (3)

Maximum Empire score.....20 points

Return of the Jedi

1. Endor (1)
2. Rancor (1)
3. Mon Mothma (1)
4. Mon Calamari (1)
5. Teebo (2)
6. To put construction of the station back on schedule (2)
7. Very beautiful but very sad (3)
8. Twenty years (4)
9. Palpatine (5)
10. Yoda, Obiwan Kenobi and Anakin Skywalker (5)

Maximum Jedi Score..... 25 points

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30-50 points You've done well but need to complete your training. You are not yet ready to take the burden.

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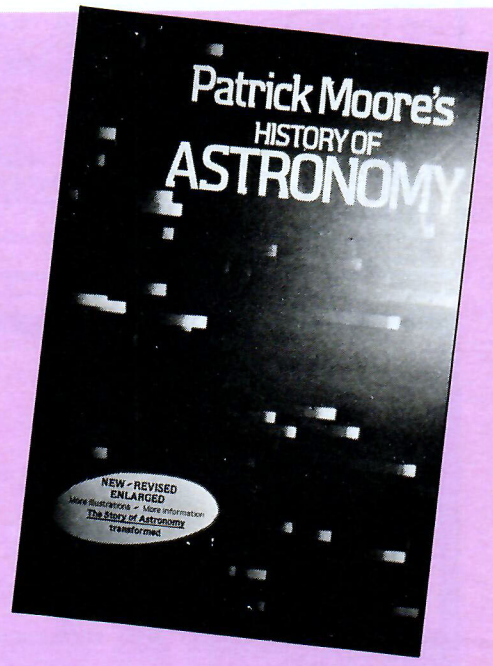

1. Who was the first Astronomer Royal?
   a: Sir Isaac Newton
   b: Rev John Flamsteed
   c: Sir William Herschel
   d: The third Earl of Rosse
2. What is the mean distance between the Sun and Mars?
   a: 35 million miles
   b: 80 million miles
   c: 140 million miles
   d: 260 million miles
3. What does IRAS stand for?
   a: International Radio Astronomy Satellite
   b: Interstellar Radar Absorption Studies
   c: Ionospheric Radio Aperture Synthesis
   d: Infra-Red Astronomical Satellite
4. Where would you find the Cassini Division?
   a: between the Earth and Moon
   b: in Saturn's ring system
   c: in the Sun's chromosphere
   d: in Jupiter's Great Red Spot
5. How often does Halley's comet visit the Earth?
   a: every 76 years
   b: every 92 years
   c: every 104 years
   d: every 110 years
6. What was the first weather satellite known as?
   a: Meteosat 1
   b: Landsat 1
   c: Nimbus 1
   d: Tiros 1
7. In which year was Sir Isaac Newton born?
   a: 1642
   b: 1646
   c: 1668
   d: 1672
8. Where is the current site of the Royal Greenwich Observatory?
   a: Flamsteed House
   b: Herstmonceux Castle
   c: Mount Hurst
   d: Birr Castle
9. Who was the first astronomer to report the existence of channels or canals on Mars?
   a: Johannes Kepler
   b: Giovanni Domenico Cassini
   c: Percival Lowell
   d: Giovanni Schiaparelli
10. What would a Centigrade thermometer at the centre of the Sun read?
    a: 1500 degrees
    b: 16 000 degrees
    c: 1 200 000 degrees
    d: 14 000 000 degrees

RULES

1. The contest will close on May 1, 1984. The first correct entry to be opened will receive the prize described above. The winner will be notified by post.
2. Each entry must be accompanied by the entrant's name, address and the special GUIZ coupon cut from this page. Each coupon covers only one entry.
3. Proof of posting will not be accepted as proof of receipt. Whilst every care will be taken, the publishers of SPACE VOYAGER cannot accept any responsibility for lost entries.
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5. The submission of a competition entry implies acceptance of these rules. The editor's decision is final and no correspondence will be entered into.

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Look at the answers suggested for each question and decide which one you think is correct. If you think the correct answer to question 1 is 'c', then your entry should read '1.c'. Answer the remaining nine questions in the same way and don't forget to add your name and address. Clip the special entry coupon and send it with your entry to:

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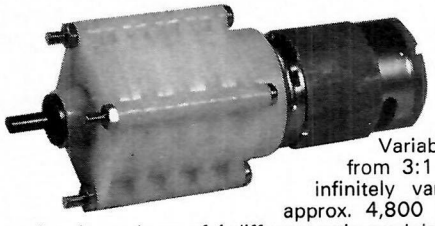

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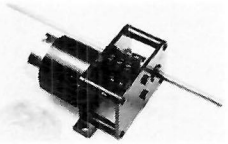

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MODEL ROCKETRY

Continued from page 61

an Altitude event but there are many more, Parachute Duration and Streamer Duration use fairly straightforward looking model rockets but there are classes that also involve the use of a gliding portion. These are Boost Glider and Rocket Glider. Both must ascend near vertically not using the lift from their wings to assist on the climb. They must then 'glide' back down taking as long as possible, it is duration that counts not altitude. Having said that, the higher they start gliding the greater the potential for duration. It is in these models that you can see the most innovation, the less drag on the way up the higher they will go. Wings that fold, swivel, slide and swing are the order of the day. Some of them carry lightweight radio-control gear as well. There are even plastic film wings that fit into streamlined body tubes, to be pushed out on ejection to become 'rogello' gliders (like the early hang-gliders).

Science fact

Not only are space models easy to build but unlike ANY flying model aircraft, you can be certain a particular model will fly first time. This does not apply to the gliding types . . . they need trimming just as does any other model aircraft. Follow the basic rules and good flights are yours right from the start. Model rockets are ideal vehicles to use as working examples for calculating various physical properties. Altitude prediction, Aerodynamic drag, Acceleration and Stability are all subjects which the practical use of space models can enhance the classroom syllabus. Flight patterns are predictable and reproduceable. The same cannot be said of the aerodynamics of their winged brothers.

Safety

Many millions of model rockets have been safely launched (. . . and landed!). Like many other everyday objects they can be mis-used but wherever they are flown and in whichever country, ALL of the clubs and societies follow a basic safety code. The American Safety Code given here has been adopted by many countries and a variation of this is being used by the British Space Modelling Association.

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Sadly at this time in the United Kingdom there are very few suppliers of space modelling goods. Most are imported from America either direct or via West Germany. If you can find them there are a number of easy to build kits that no-one should have any trouble to construct. These range from beginner's models to a number of scale models such as the Mercury Redstone, a V2 and even a three foot six inch Saturn V.

BSMA

For those interested in learning more about the British Space Modelling Association write to: 15, High Street, Ditchling, Sussex BN6 8SY. Please enclose an S.A.E.

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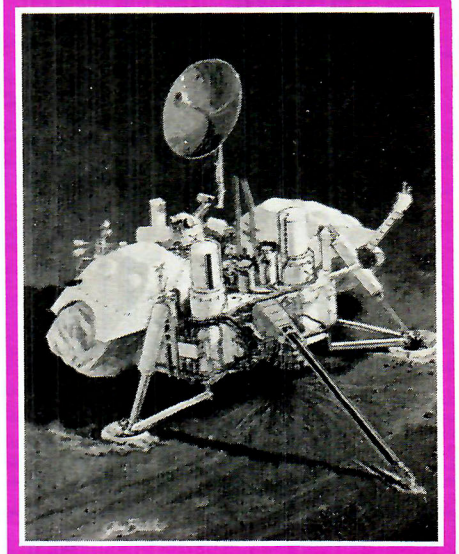
PATRICK MOORE
What do you need to make your first astronomical observations? A telescope of course! Wrong. Patrick Moore writes on the best way to get into astronomy, starting from scratch.

TERRAHAWKS
Mark Gorton goes into overdrive and produces not only his sparkling and incisive home video column but also a Voyager special report on that dazzling Gerry Anderson television extravaganza, Terrahawks.

JAPAN IN SPACE
Dr J K Davies of Leicester University's department of astronomy looks eastwards to the land of the rising Sun and investigates Japan's activities in space for Voyager.



VIKING ON MARS
Viking project scientist Dr Conway Snyder gives a personal account of the Viking programme in his 'visit to a rusty planet'.

And as if that wasn't enough, Peter Freebrey continues his foray into the world of model rocketry, Micro Wars goes computer space gaming and we cover all the news from the American, European and soviet space programmes. All this and more from the UK's premier science fact/fiction/fantasy magazine.

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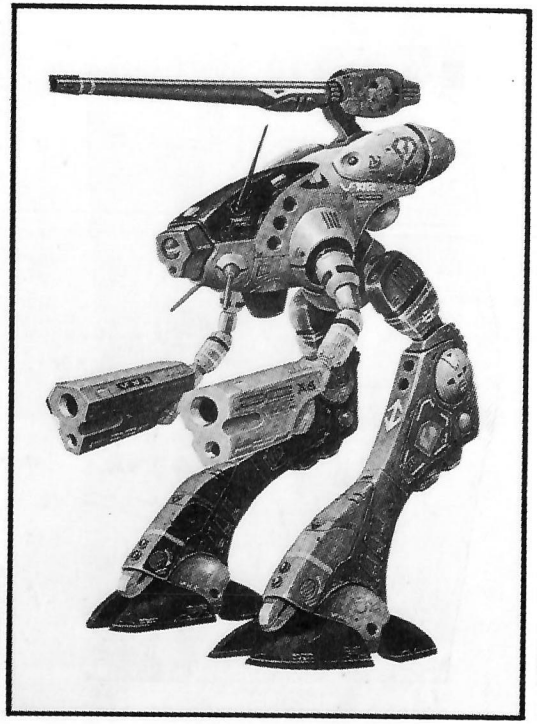

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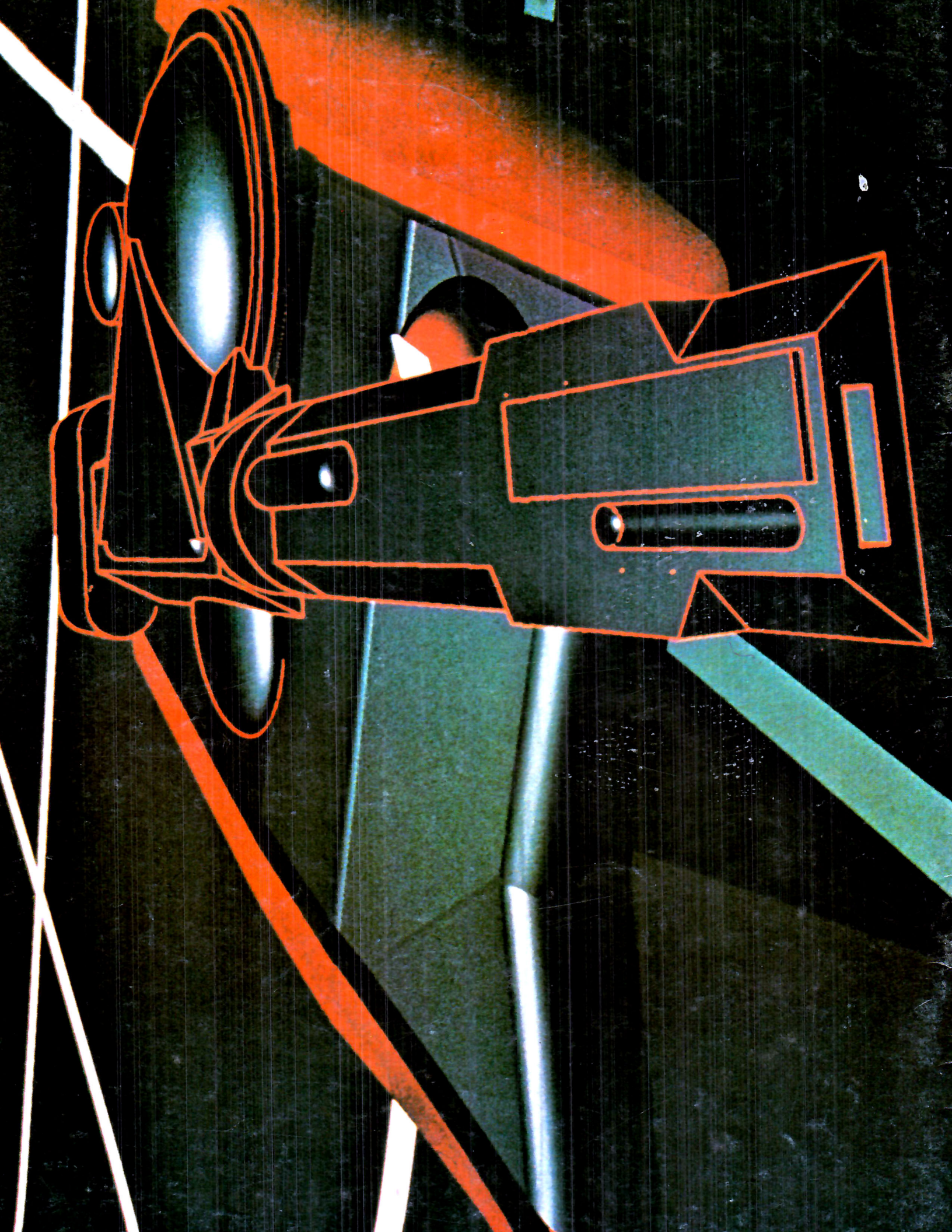
STAINES

TEL: 0784 51168